# The Impact of Globalisation on Food Availability and Access in Developing Countries: A Case of Malawi

By

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# Declaration

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# Abstract

Globalisation has affected food systems in the world and the world's poor in so many ways. The increased process of globalisation has had a major impact on food security around the world and with it a greater impact and increased importance in the lives of producers and food consumers.

There are traces that the impacts of globalisation have not spared Malawi's food and agriculture sector. Over the years, communication technology, the use of biotechnology and access to information has improved. Additionally, food systems have changed due to international trade and this has led to the increased presence of supermarkets. With all these improvements, it is not well known if all these factors have had any success in reducing food insecurity and its effects. This study aimed to investigate the effects of globalisation on food availability and access in Malawi, where food availability and access are indicators of food security.

The study has two study periods, the first period is from 1970 to 2016 and the second study period is from 1987 to 2013. The first study period covers the data for the first model which investigates the impact of globalisation on food availability which was proxied by maize production, while the second period constitutes data for the second model which investigates the impact of globalisation on food supply.

Other factors identified that could affect food availability and access that were included in the model are: food prices, weather changes, the area of cultivated land, population growth, per capita Gross Domestic Product (GDP), the farm input subsidy programme and other input subsidy programmes such as starter pack and supplementary input programmes. The study employed an Autoregressive Distributive Lag model for its analysis, which is a time series model that includes lagged values of the variables of interest and traces relationships among them over time.

The findings from the models indicate a positive impact of globalisation on food availability and access, particularly on maize production and food supply which have been selected as measures of food availability and access in Malawi. Specifically, the results for the short run and long run model show that globalisation has a positive impact on maize production. Similarly, the findings of the impact of globalisation on food supply also indicate a positive impact for both the short run and long run model.

The implication for the results is that globalisation is associated with diffusion of agricultural and information technology. This increases access to improved agricultural technologies.

From the findings, it can be concluded that; even though it is established that globalisation has a positive impact on food availability and access in Malawi, the magnitude of the effect is minimal as indicated by the estimated coefficients of maize production and food supply. Therefore, deliberate interventions have to be made to ensure that the benefits of globalisation are enhanced.

# Opsomming

Globalisering het voedselsisteme in die wêreld en die wêreld se armes op soveel maniere beïnvloed. Die toenemende proses van globalisering het 'n groot impak op voedselsekerheid oor die hele wêreld gehad, en daarmee saam 'n groter impak en 'n groter belang in die lewens van produsente en voedselverbruikers.

Daar is aanduidings dat die gevolge van globalisering nie die voedsel- en landbousektor in Malawi gespaar het nie. Oor die jare het kommunikasietegnologie, die gebruik van biotegnologie en toegang tot inligting verbeter. Boonop het voedselsisteme verander weens die internasionale handel, en dit het gelei tot ‘n toename in die teenwoordigheid van supermarkte. Met al hierdie verbeterings is dit nie goed bekend of al hierdie faktore suksesvol was met die vermindering van voedselonsekerheid en die gevolge daarvan nie. Hierdie studie het ten doel gehad om die gevolge van globalisering op beskikbaarheid en toegang tot voedsel in Malawi te ondersoek, waar beskikbaarheid en toegang tot voedsel aanwysers van voedselsekerheid is.

Die studie het twee studietydperke, die eerste periode is van 1970 tot 2016 en die tweede studietydperk is van 1987 tot 2013. Die eerste studieperiode dek die data vir die eerste model wat die impak van globalisering op die beskikbaarheid van voedsel ondersoek, wat verteenwoordig word deur mielieprodukise, terwyl die tweede periode geld vir die tweede model wat die impak van globalisering op voedselvoorraad ondersoek.

Ander faktore wat voedselsekerheid kan beïnvloed wat by die model ingesluit is, sluit in: voedselpryse, weersveranderinge, die oppervlak bewerkte grond, bevolkingsgroei, die bruto binnelandse produk per capita, die inset-subsidie-program vir plase en ander inset-subsidieprogramme, soos die beginpakket en aanvullende insetprogramme. Die studie gebruik 'n Autoregressive Distributiewe Sloerings-model vir die analise. Dit is 'n tydreeksmodel wat sloerings insluit van die relevante veranderlikes en verbande tussen hulle oor tyd naspeur.

Die bevindinge van die modelle dui op 'n positiewe impak van globalisering op voedselsekerheid, veral op mielieproduksie en voedselaanbod, wat gekies is as maatstawwe vir voedseltoegang en -beskikbaarheid in Malawi. Spesifiek, die resultate vir die korttermyn- en langtermynmodel toon dat globalisering 'n positiewe invloed op mielieproduksie het. Net so dui die bevindinge van die impak van globalisering op voedselvoorraad ook op 'n positiewe impak oor sowel die korttermyn- as langtermyn.

Die implikasie hiervan is dat globalisering verband hou met verspreiding van landbou- en inligtingstegnologie. Dit verhoog toegang tot verbeterde landboutegnologieë.

Uit die bevindinge kan afgelei word dat alhoewel globalisering 'n positiewe impak het op die beskikbaarheid en toegang van voedsel in Malawi, die omvang van die effek minimaal is, soos aangedui deur die beraamde koëffisiënte van mielieproduksie en voedselvoorraad. Daarom moet daar met doelbewuste ingryping verseker word dat die voordele van globalisering verhoog word.

# Acknowledgements

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**Acronyms**

| | |
|---|---|
| AIC | Akaike Information Criteria |
| AFDB | African Development Bank |
| AGOA | African Growth and Opportunity Act |
| AIDS | Acquired Immune Deficiency Syndrome |
| ARDL | Autoregressive Distributed Lag |
| COMESA | Common Market for Eastern and Southern Africa |
| CPI | Consumer Price Index |
| CABS | Common Approach to Budget Support |
| DFDI | Department for International Development |
| DOS | Dynamic Ordinary Least Squares |
| EAC | East African Community |
| EU | European Union |
| FAO | Food and Agriculture Organization |
| FISP | Farm Input Subsidy Programme |
| FDI | Foreign Direct Investment |
| GDP | Gross Domestic Product |
| GPS | Generalised System of Preference |
| GMM | Generalized Method of Moments |
| IFAD | International Fund for Agricultural Development |
| IFPRI | International Food Policy Research Institute |
| KOF | Konjunkturforschungsstelle |
| MFN | Most Favoured Nation |
| ODA | Official Development Assistance |
| $ | United States Dollar |
| SADC | Southern Africa Development Community |
| SP | Starter Pack |
| SIP | Supplementary Input Programme |
| TNC | Transnational Corporation |
| WFP | World Food Programme |
| UN | United Nations |
| UNCTAD | United Nations Conference on Trade and Development |
| UNDP | United Nations Development Programme |
| VEC | Vector Error Correction |
| WTO | World Trade Organization |

# CHAPTER 1: INTRODUCTION

## 1.1 Background Information

In a world where protectionist sentiment seems to be increasing, it is important to understand how different countries are impacted by globalisation or the lack thereof. Even in the era of globalisation many African countries still face the issue of chronic food insecurity and one of the countries still being faced with food insecurity is Malawi (Pinstrup & Cheng, 2009). Chronic food insecurity and poverty are closely linked in Malawi (Harrigan, 2008).

Malawi is a landlocked country situated in the Southern Region of Africa. The country is divided into 3 regions: The Northern, Southern and Central Region. Agriculture is considered as the backbone of the economy, because it constitutes one third of the GDP. 85% of the population in Malawi dwells in the rural areas while 75% of the population depend on agriculture for their livelihoods (Øygard, 2003).

In terms of land ownership, the land is split between smallholder farmers who own 0.23 hectares on average with large estate holders who grow tea, rice, coffee and tobacco for export purposes. These crops are a source of 90% of foreign exchange earnings after they are exported (Øygard, 2003).

80% of the Malawi population consume maize as their main staple (FAO, 2014). Maize production is mainly rain fed and any weather-related shocks leads to a shortage. Maize production is regarded as food security and sufficiency in Malawi since its independence in 1964. Malawi being a landlocked country solely relies on domestic food production (Devereux, 1997).

In this study, maize production is used as a proxy for food availability from the year 1970 to 2016. On the other hand, the study also measures food access using food supply as a proxy. Food supply is one of the indicators of food security and it corresponds to the dimension of stability as disseminated by FAOSTAT (FAOSTAT, 2019). Food supply is expressed in Kilocalories per capita per day. This indicator estimates food supplies available for consumption per capita during a given period (Napoli et al., 2011). (More details are provided in Chapter 4 under variable description).

According to the World Agriculture Report: Towards 2015/2030, a study by the United Nations Food and Agriculture Organization (FAO) in 2001, finds that there is sufficient food to feed the growing global population. However, a large proportion of people in developing countries

are still predicted to remain hungry. The question that arises is why would people remain hungry if there is enough food?

Several programs have been rolled out in developing countries to push towards goals of adequate food supply but despite all the efforts channeled towards food security eradication, there are still many people worldwide that are undernourished, approximately 795 million people. Of the 795 million people that are undernourished, 780 million of them reside in developing countries. Southern Asia and Sub-Saharan Africa are the continents that have made the least progress in reducing food insecurity and hunger globally (FAO, IFAD & WFP, 2015). Even though this is the case, many countries are becoming more globalized and cross border costs are becoming lower and lower. It is therefore not clear whether globalisation has affected food security in developing countries or not. And in particular the focus in this study is on Malawi.

There are traces that the impacts of globalisation have not spared Malawi's food and agriculture sector. Over the years, communication technology, the use of biotechnology and access to information has improved. Additionally, food systems have changed due to international trade and this has led to the increase of the presence of supermarkets. With all these improvements, it is not well known if all these factors have had any success in reducing food insecurity and its effects.

Globalisation is a process of cooperation and convergence between individuals, industries and governments of different nations, a process guided by international trade, capital investment, information technology, finance, industry and development technology (Wade, 1996, Islam, 1999 & Aninat, 2002). Globalisation can be described in a simpler way as the promotion of human interaction across national boundaries. The increased process of globalisation has had a major impact on food security around the world and with it a greater impact and increased importance in the lives of producers and food consumers.

This increase in importance suggests that the magnitude of global relations in the agri-food sector has increased significantly. Food systems are therefore evolving, resulting in greater quality, availability and diversity of food (Kennedy, et al., 2004). The changes in food systems are closely associated with urbanization, market liberalization, rising incomes and foreign direct investment. Such changes affect food availability and access by improving food production, supply and distribution systems, and the food trade environment (Kennedy, et al.,

2004). Notably, all the main drivers of globalisation cause the shifts in food systems. This study therefore explores the effect of globalisation on food availability and access in Malawi.

## 1.2 Problem Statement

Globalisation is driven by international trade, capital investment, information technology, business and technology of production; these characteristics indicate that there has been an improvement in global connection in the agricultural food sector as well. That means that it is important to consumers and farmers, because it affects food patterns, production, increase in flow of goods and services and Foreign Direct Investments (FDI) across borders (Anderson, 2010).

Other components of globalisation such as foreign direct investments also complement international trade, and the facilitation of the transformation of the food system through the expansion and spread of supermarkets (Reardon & Timmer, 2007). Other advantages of globalisation include: raising of output, productivity, job creation, raising of wages and the lowering of prices of products.

However, whether globalisation has an impact on food security has been the question of research (Lee, 2005). Little is known on the impact of globalisation on food security in developing countries. This research seeks to address this knowledge gap by identifying the impact of globalisation on food availability and access in Malawi.

Previous studies have focused on the impact of globalisation on indicators such as Gross Domestic Product (GDP), trade and poverty. None of the studies however have explained the impact of globalisation on food security. Furthermore, the effectiveness of key indicators of globalisation such as trade openness, foreign investment, transfer of technology, introduction of new crop varieties on food security has not been properly defined and quantified. This study therefore seeks to contribute to gaps in the existing literature by focusing on investigating the impact of globalisation on food availability and access which are some of the indicators of food security. The research also contributes to the current understanding of globalisation and the contribution it has made in improving the access and availability of food in developing countries with the focus on Malawi.

## 1.3 Objectives of the Study

The main objective of the study is to evaluate the impact of globalisation on food availability and access in Malawi. Specifically, the objectives are:

- To analyze globalisation, maize production and food supply trends.
- To investigate the impact of globalisation on maize production.
- To investigate the impact of globalisation on food supply.

### 1.4 Hypotheses of the Study

The study investigates the following hypotheses:

- There is a short run response of maize production to globalisation in Malawi.
- There is a short run response of food supply to globalisation in Malawi.
- There is a long run relationship between globalisation and food supply in Malawi.
- There is a long run relationship between globalisation and maize production in Malawi.

### 1.5 Approach, Data and Methodology

To analyse the trends for globalisation, maize production and food supply, the study combines both descriptive and regression analysis using data obtained from FAO, World Bank Database and Swiss Economic Institute.

In order to investigate the impact of globalisation on food availability and access in developing countries with the focus on Malawi, the study employs an Autoregressive Distributed Lag (ARDL) model to estimate the coefficients of the variables in the study. Two different ARDL models were specified to estimate the impact of globalisation on maize production and the impact of globalisation on food supply respectively. Other factors affecting food security were also included in the model as variables together with globalisation.

ARDL models are standard least squares regressions that include lags of both the dependent variable and explanatory variables as regressors (Greene, 2003). This is a method of choice because the analysis uses time series data and it combines short run and long run coefficients in a single equation thereby minimizing estimation errors and producing more accurate estimates. Furthermore, the approach works well with small samples and even when the variables are of different integration orders (Nkoro & Uko, 2016).

The study uses annual time series data from 1970 to 2016 for the variable maize production, and data from 1987 to 2013 for the variable food supply. Data on maize production and food supply was obtained from the FAOSTAT website, while annual data on percentage size of agricultural land, population growth and GDP per capita was obtained from World Bank

Development website. The KOF globalisation index was obtained from the Swiss Economic Institute. The KOF globalisation is an index that combines different facets of globalisation into one index. The index was introduced by Dreher (2006) and was later on updated by Dreher et al. (2008). It measures the economic, social and political aspects of globalisation since 1970 (Gygli et al., 2019).

### 1.6 Outline of Thesis

This thesis proceeds as follows: chapter 2 presents the review of literature on globalisation and food security and literature on the methodology. Chapter 3 reviews Malawi's state of globalisation; the various components of globalisation and the position at which Malawi stands in terms of globalisation and food security.

Chapter 4 provides a discussion of the method that has been used in the study. The results and discussion from the analysis are presented in Chapter 5. The results also constitute the outputs from the models and all the performed diagnostics. Chapter 6 gives a conclusion together with policy recommendations.

# CHAPTER 2: LITERATURE REVIEW

## 2.1 Introduction

This chapter provides an overview of the review of literature on globalisation and food security. The first part of the literature review explains the theory behind globalisation particularly concerning trade openness and the connectedness of the subcomponents of globalisation particularly related to this study. Furthermore, the chapter explains the role of globalisation on agriculture and the food sector in developing countries. The literature will then provide a detailed review of the findings from other studies that have been published on globalisation and food security, and the studies that have employed the ARDL model as a methodology for analysis.

## 2.2 Theory Behind Globalisation

Wade (1996), Islam (1999) and Aninat (2002) defined globalisation as a process of cooperation and convergence between individuals, industries and governments of different nations, a process guided by international trade, capital investment, information technology, finance, industry and development technology.

Globalisation has brought interconnectedness of trade, cultural exchange and ease of movement of goods and services which involves transnational corporations (TNCs) which have established subsidiaries in many countries. This makes it easy for free movement of capital, goods and services. The process is made even easier because of the improvement in the transportation and communication systems, freer trade and improves the availability of cheap labour and skills. These also impact foreign direct investments through the TCN activities, which in turn impact the economic, social and cultural changes (Letto-Gillies, 2012).

Globalisation emphasizes on the degree of integration. In the case of TNCs, integration is aimed at reaching the global market. The standard trade theory suggests that globalisation has positive impacts on reducing poverty in LDCs (Dollar & Kraay, 2004). Economic integration dates back to Adam Smith and David Ricardo that made their arguments based on free and international trade and the benefits it has to the world. Ideas from a mercantilist point of view focused on the importance of the accumulation of power by the state, in order to control the economy while Karl Max emphasized on the idea of expanding the world. The idea of expanding the world was from a capitalist point of view.

The debate on the expansion of the world intensified after World War II. The focus was on the costs and benefits of expansion. The broad view was to promote interdependence among nations. This idea was in line with David Ricardo's Principle of comparative advantage. Comparative Advantage is an International trade theory which was introduced by David Ricardo in 1817. He first explained the principle of comparative advantage in his book 'Principles of Political Economy and Taxation'. David Ricardo's proposition became popular following Adam Smith's argument on trade liberalization. The principle of comparative advantage was used to explain the benefits of trade between economies with different opportunity costs in production (Abbott et al., 2008; Chang et al., 2009). Countries produce goods at different costs, due to differences in a country's resources. This fact is crucial for trade because it allows for countries to purchase goods from abroad more cheaply than it can produce that particular good at home. Comparative advantage provides the basis for foreign trade.

Ricardo's theory stipulated that if a country has comparative advantage in all goods, countries could still gain from trade because of the difference in relative efficiencies. Ricardo also emphasized that countries should specialize in production of goods that they are very relatively productive in producing even when they have absolute advantage in many other goods.

### 2.3 Defining Globalisation and its Subcomponents

Globalisation has different components. In the past, indicators, reflecting openness which encompasses trade as a percentage of GDP have been used as a proxy for measuring globalisation (Gygli et al., 2019). However, globalisation has multiple sub-components, it encompasses not only trade openness and capital inflows, but it has other vital components such as communication, the sharing of ideas and information by people in different countries and governments tackling political problems together to achieve global goals. KOF Globalisation is an index that combines different facets of globalisation into one index. The index was introduced by Dreher (2006) and updated in Dreher et al. (2008), and it measures economic globalisation as well as other social and political aspects of globalisation (Gygli et al., 2019).

This study makes use of the overall index, and the subcomponents that make up the overall globalization index are elaborated in the following section to show clearly the composition of the overall index. The subcomponents of the overall index are subsequently discussed.

### 2.3.1 Economic Globalisation

Economic globalisation, has sub-dimensions such as trade globalisation which refers to the transfer and exchange of goods and services across borders and over long distances. This aspect is measured using exports and imports which are expressed as a share of GDP. In order to account for the geographical distribution linkages in trade, a variable that is used to compute the trade diversity is used (Gygli et al., 2019). This is the inverse of the average Herfindahl-Hirschman partner concentration index for exports and imports of goods. In this index the countries are indexed together with their trading partners and the more dispersed the imports and exports are over the different trading partners, the lower the HHI and the higher the value of the variable (Gygli et al., 2019).

On the other hand, trade globalisation also encompasses the policies that promote trade flows between countries. The variable measures the trade regulation, taxes, tariff rates and agreements in trade. When it comes to trade regulation, there are two sub-components that make up trade regulation; the prevalence of non-tariff trade barriers and the compliance costs of exporting. The variable that measures trade taxes is income taxes from the share of income from taxes that are realized from international trade of the total income of a country while the tariff rates is the mean of unweighted tariff rates. The trade regulation variables; taxes and tariff rates are calculated as the inverse of normalized values such that the higher the value, the higher the level of trade globalisation. Free trade agreements are a compilation of multilateral and bilateral trade agreements (Gygli et al., 2019).

### 2.3.2 Financial Globalisation

Financial globalisation is measured by the flows of capital, stocks, assets and liabilities. The variable comprises of foreign direct investments, portfolio investments, international debt and reserves. The variables are calculated as the sum of the asset and liabilities as a percentage of GDP. The sum of primary income payments and receipts as a share of GDP are also included. The financial dimension also measures the openness to a country to international flows and investments (Gygli et al., 2019).

### 2.3.3 Social Globalisation

**Interpersonal Globalisation**

This is a variable that measures the number of mobile phones and telephone subscriptions per every 100 people, international voice tariffs, financial transfers, international tourism and the

share of the people born foreign. All the variables are measured in relation to the domestic population (Gygli et al., 2019).

**Informational Globalisation**

Information globalisation is measured using three variables. These variables include; the stock of applications that are made by non-residents and the sum of in and out-bound international students. The variables represent he international flow of technology, scientific knowledge and related information. These variables are divided by the population size, in order to determine the impact of the foreign information on the national beneficiaries and actors. The variable patent applications is a proxy for information flow (Gygli et al., 2019).

Informational globalisation can also be measured using the number of televisions by household and internet access per household. Additionally, the press freedom measures how easily people access information through the news. The index portrays media independence, the degree of print, broadcast and digital media freedom (Gygli et al., 2019).

**Cultural Globalisation**

The variables that make up cultural globalisation focus on cultural assimilation within countries. The variables describe the transmission of cultural values by means of sharing cultural goods and services. Trade in cultural goods is also included in the variable, trade in personal, cultural and recreational services which are presented as a sub-component for the balance of payments (Gygli et al., 2019).

The variable also refers to the openness and the ability to understand the cultural influences. There are three important factors that are included and used to measure the understanding of a language and accepting the cultural value of foreign countries. It is assumed that having an equal egalitarian promotes the flow of cultural activities such as gender parity index on gross primary enrollment which indicates the parity of boys and girls. This is also an indicator of the equality between men and women (Gygli et al., 2019).

**Political Globalisation**

Political globalisation captures diffusion of government policies. The variable measures participation in UN Peacekeeping missions, number of embassies and the number of international NGOs in a country (Gygli et al., 2019). The number of embassies shows the foreigners that are acting in the home country's interests. The number of international NGOs indicate the number of internationally oriented NGOs in a country (Gygli et al., 2019).

Political globalisation also refers to the ability of countries to engage in the international cooperation. Usually, this is measured by the number of treaties that a country has signed since 1945, the number of memberships with international organizations. In addition to that, this variable also measures the willingness of creating networks among the partner countries.

### 2.4 Food Security

FAO defined food security as 'a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.' (FAO, 2006). This definition highlights the generally accepted four dimensions of food security: 1) food availability, 2) food access, 3) utilization and 4) stability (FAO, 2006).

From the above, it is possible to identify four key dimensions of food security: physical availability covers the food security supply side and is assessed by the level of food production, stock levels and net trade. Food availability refers to food available at national level rather than at household level (Napoli et al., 2011).

Access refers to the physical access to food and social access of food. Individuals may have access to food through a combination of household production, purchase, barter, gifts, borrowing, or food aid. Utilization is the element that focuses on how safe and nutritious the food is and whether it meets the dietary needs of the people. The last component which is stability refers to availability, access and utilization. Stability captures all the indicators of food security, because it affects all three components of food security (Napoli et al., 2011).

The definition of access was pioneered by Nobel Prize winning economist, Amartya Sen. He defined food insecurity in his book "Poverty and Famines" as a failure of livelihoods to ensure access to sufficient food at the household level rather than simply a failure of agriculture to produce enough food at national level (FAO, 2002).

Besides defining food security, it is important to briefly stipulate the underlying causes of food insecurity problems and to give a summary of some of the indicators of food security. One of such indicators is food availability and access which have been selected as the focus for this study. The section below provides a brief overview of the causes and the different indicators thereof.

#### 2.4.1 Causes of Food Insecurity

Food insecurity causes are categorized as follows: 1) factors contributing to food insecurity in rural areas; 2) factors contributing to food insecurity in urban areas; 3) trade-related factors

contributing to food insecurity; and 4) other factors contributing to food insecurity (technology, institutions) (FAO, 2002).

Lack of an open and transparent trade system that promotes agriculture and rural development in developing countries; persistent insecurity of land tenure and access to land, water and natural resources; inadequate producers access to relevant technology, inputs and institutions, and high levels of food waste, drought, floods and other natural climatic disasters are major destructive factors in food production. These are the common causes of food insecurity in rural areas. While in urban areas, with growing rapid urbanization in many countries and reliance on food purchases by urban households, food insecurity in the future will increasingly affect urban residents. Moreover, international trade laws, trading partners' policies and shifts in the international price of agricultural commodities can have a significant impact on the economy of the country and on the food security of its inhabitants (FAO, 2002). Trade laws play a significant role in determining food security within a country as they dictate how countries should conduct themselves as they trade food and farm products.

In certain developing countries, especially SSA countries, international trade laws, trade partner policies and shifts in international agricultural commodity prices have helped countries make strides in ensuring food security (FAO, 2002). Kennedy et al. (2004) stated that globalisation can improve food availability and access through production, procurement, distribution and the food trade environment. The question in this study is whether this has been the case for developing countries such as Malawi.

### 2.4.2 Food Security Indicators

Food security is determined by four aspects, which are: food availability, food access, food consumption and nutritional status (Dereux & Maxwell, 2001). Different fields use different indicators for food security. Nutritionists for instance argue that nutritional status is a sufficient indicator of food security at national and household level. Nutritional status indicates the number of undernourished citizens and individuals in households. The nutrition status however, has other factors that are not food related, such as water quality, health and sanitation. These are regarded as indicators for wellbeing, but are included in determining food security to show the quality of the diet (Dereux & Maxwell, 2001).

On the other hand, agricultural economists claim that food production is the key determinant of how food secure a nation is especially in the Sub-Saharan region. Besides food availability through domestic production, other food sources such as imports and stocks also contribute to food availability. Food availability would be higher if the nation imported a substantial amount

of food, similarly, food availability would become less if some of the food was exported (Dereux & Maxwell, 2001).

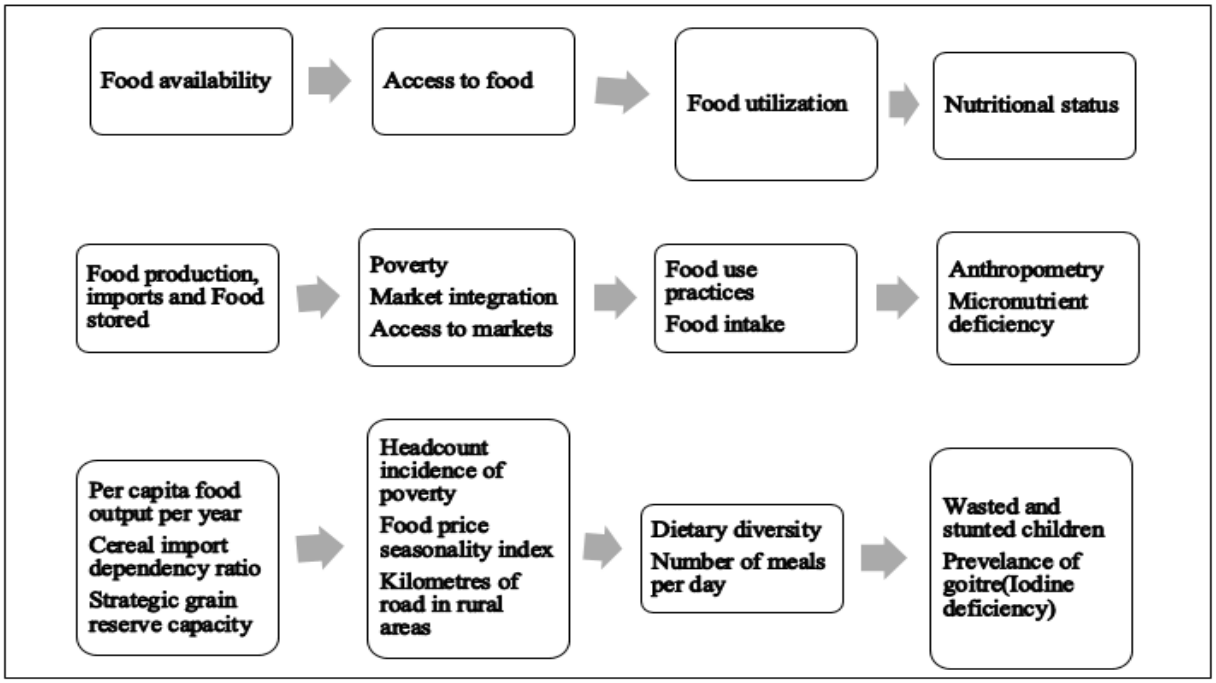
According to Schultz (1964), food security depends on overall policies, economic development and not just agricultural development. Schultz (1964), also added that, food security is more than access, but has other fundamental dimensions such as availability and utilization. Availability entails the supply of food from production, imports, or stocks. Amartya Sen observed that during the severe Bengal famine of 1943, food was available, however people did not have access to food due to lack of buying power, a situation whereby higher economic productivity would have diminished, the price was excessive, this situation caused freer trade and the diminishing of larger stocks and that the consumers did not have access to transfers, which was a situation that a great sense of community diminished (Schultz, 1964).

Most insecure people live in rural areas of developing countries, food production (availability) which is also buying power (accessibility) for several people. Raising food prices above market levels by government programmes cause food insecurity even though food producers find it advantageous. In spite of that, increasing the food access by increasing productivity and real incomes of poor people is the most principle way to address food insecurity (Tweeten, 1999).

Additionally, utilization which is another fundamental dimension of food security entails the metabolization of food by the body. People are food secure when they are able to utilize the food properly. Many people are food insecure due to lack of nutrition education, food preparation, bad habits, eating disorders, poor health including intestinal parasites from contaminated water. Consequently, that means that education and health care are essential in ensuring food security (Tweeten, 1999).

The framework below illustrates the relationship between the food variables and indicators of each of the variables that can be used in the assessment and monitoring of food security. The framework shows the interlink between food availability, access, consumption and nutrition, implying that any intervention in the stage of the framework has an impact on achieving the goal of reducing food insecurity. Some policies that have been implemented to improve access to food, these policies include: providing income through cash transfers, cash for work projects and other food consumption improvement programmes like school feeding programmes that are implemented in schools.

*Figure 2. 1: Framework of the relationship between variables that measure food security*




Source: Dereux and Maxwell (2001)

## 2.5 The Role of Globalisation in Food Security

Agricultural commodity production has increasingly become embedded in linkages which today are more global than half a century ago, whether through suppliers of inputs to agricultural production or through the manufacturing, distribution and selling of agri-food products. Over the same period, trade has increased in both agricultural commodities and processed products (Coleman et al., 2004).

The effects of globalization have not spared the food chain. The concept of globalization carries with it images of communications no longer fettered by physical distance, the construction of human relationships across long-standing barriers imposed by a specific location and time, and the melting away of territorial boundaries imposed on communities including nation-states (Coleman et al., 2004)

Globalization is therefore a more important factor in farmers ' and food consumers ' lives than it was years ago. This increase in importance means that the frequency of international relations in the agri-food sector has increased significantly.

Notably, globalisation entails the joining of forces across national borders to achieve specific goals. Mostly, the essence of globalisation is the extension of the national boundaries of the same economic processes that inspire trade in the form of exchange and specialization. The

essence of exchange and specialization encourages nations to specialize in producing one kind of a good or service.

Growth in global food supplies are regarded as a necessary but not sufficient condition for addressing food insecurity and malnutrition. Food security issues include availability, stability, accessibility, sufficiency, autonomy, reliability, equitability and sustainability. It has been asserted that globalisation has impacts on food security through: agricultural trade regulations, measuring food security based on supply availability, nutritional security as per household or individual needs and growth in biotechnology. Increase in biotechnology could improve yield potential, raise productivity even on land that has lost its fertility and that is not able to produce enough food to feed the people (Williamson, 2001).

Globalisation has become a widely debated issue in recent years. There are a number of aspects that form the core of characteristics of the phenomenon; for example, economists have tended to view globalization in terms of eliminating trade barriers to international trade, historians and geographers have emphasized the development and transformation of the world system, while sociologists have centered their attention on the process of production and consumption. Despite the disciplinary discrepancies, there has been agreement in favour of the idea that globalization is emerging in the form of a new international division of labour (Bonanno et al., 1994).

The effects of globalisation such as improvement in information, education and the communication activities have influenced food security positively in terms of technology; phones and radios. The mobility of finance and production factors between countries has also increased in recent years, with the increase in transportation, communication and technology links between countries. Globalisation undoubtedly produces large effects in different sectors of a country (Nayyar, 2006).

Mellor (2002b) argued that globalisation will greatly enhance the role of agriculture as a growth engine in low-income countries by enabling agriculture to grow significantly faster than domestic consumption. Furthermore, globalisation increases the potential for agriculture to increase food security through increased multipliers for the large, employment-intensive, non-tradable rural non-farm sector (Mellor, 2002b). With these potential benefits, it is important to understand what is required to ensure that these processes lift the poor and hungry from poverty and hunger (Mellor, 2002b).

According to Braun and Bonilla (2008), globalisation in its complexity, affects the world's food and agricultural economy in several ways. Globalisation promotes for export-oriented cash crops, free trade, and deterrence of subsidies, presumption on standards and the compliance of property rights. Globalisation is envisaged with food security through increasing the availability of food grains, increasing the access of food for all people including the poor, increasing employment opportunities and cash crops to increase foreign exchange earnings (Braun & Bonilla, 2008).

Furthermore, globalization also encompasses the agricultural information system. The system consists of the development, documentation and dissemination of information (Achleitner, 1995). Farmers need access to information: to take advantage of niche markets, on the products needed, and also whether they have the comparative advantage in producing those products in relation to other potential suppliers.

Cost reduction and associated increase in production are constantly taking place in agriculture, and the pace is accelerating, partly due to the forces of globalisation. Technological change that reduces costs is the product of applied research, which is increasingly dependent on constantly advancing basic research (Mellor, 2002a).

Globalisation has driven agricultural production to grow faster than it has in the past. A few decades ago, growth was more than 3% per year, compared to 4% to 6% at the moment. Moreover, higher growth rates mean a significant shift in the composition of production. The bulk of growth initially came from basic food staples when the scope for export markets was small, although there is now a move towards much higher value commodities. Explosive income growth in high-income countries means that large aggregates of output can now occur in what were previously small niche markets. Examples of this are high-quality coffee and tea. Also the demand for exports of horticulture has expanded tremendously and can continue to expand (Mellor, 1992).

Domestic demand for high-value livestock and horticulture is also increasing rapidly as exports of high-value agricultural commodities increase and multipliers to per capita income grow. Therefore, even in low-income countries, about half of the rise in agricultural production will be in high-value horticulture and livestock for both export and domestic use.

As the production mix shifts more towards export crops and high-value crops and livestock, the investment return rate that lowers transaction costs will rise rapidly. The same applies to

all value-added enterprises ' investments. Nonetheless, there is a value-added limit. Much of this work is done by means of capital-intensive methods. Both will give high-income countries a comparative advantage. Low-income countries need to pay attention to the comparative advantage at every stage of the chain from supplier to customer and should not attempt components where they lack a comparative advantage. Cereals have an important role to play in food security in the global economy. Shipping costs are declining. Two forces could lead to increased cereal imports in developing countries. In the first place, globalisation and specialization may lead to an increase in the area planted to high-value commodities and may lead to a decrease in the area planted to cereals if either increased production intensity (i.e. double-cropping) or intensification is not possible. Second, any change in the distribution of income towards low-income food insecurity would move the demand pattern upwards. Thus, low-income countries may be beneficiaries of declining cereal prices, even while they lose from declining prices of other agricultural commodities (Mellor, 2002a).

Increased incomes of poor people are a key factor in ensuring food security. The marginal propensity of poor people to spend on food is higher when people have more income. The primary means by which low-income people increase their incomes and therefore their food security is through increased employment (Mellor, 2002a). Agricultural development lowers poverty levels, and the actual effect of agriculture relies on growth rates that are significantly higher than the growth rates of the population. The latter are indirect, working through their impact on the demand for rural non-tradables, which occupy a high proportion of the total labor force and the bulk of the poor and food insecure (Ravallion & Datt, 1996).

Agriculture needs to grow substantially faster than population growth to have a significant impact on employment. If it is to expand at the rates of 4 to 6% needed to achieve employment levels that are important to food security, then major agricultural products must be exported. This will include conventional bulk exports of horticulture, including cotton, coffee, tea, palm oil and non-traditional exports. Globalization requires constant cost reduction through research and development, as well as constantly reducing the rising transaction costs through increasing investment in rural infrastructure. Without them, a country cannot survive: it is no accident that African nations are suffering the most from declining commodity prices (EQI, 2002).

### 2.5.1 Globalisation and Food Systems

#### 2.5.1.1 The Food System Definition and Components

The food system includes all food related activities such as planting, harvesting, storage, manufacturing, processing, distribution, consumption and the environment that the activities take place. These include the social, economic and political environments (Pinstrup & Watson, 2011).

The major components of the food systems are made up of food production, transportation, distribution and consumption. In addition, the food system is linked to technology, the natural environment, social factors and government food policy.

Major global shifts in consumption, marketing, production and trade are driven by four major drivers: rising incomes, demographic shifts, food chain management technology, and globalisation (McCullough et al., 2008). Globalisation has a major impact on food systems worldwide. In this context globalisation means reducing barriers to the movement of goods, services and capital across borders, the flow of products, technology, information, financial capital, modes of distribution and marketing and, to some extent, human and labour migration (Shetty, 2003). The primary drivers of changes in food systems impact food availability and access through improvements in food production, procurement and distribution systems, and the world of food trade. This in turn brings about a gradual shift in patterns of consumption and nutritional status of the strata (Kennedy et al., 2003).

#### 2.5.1.2 Food Production System

Globalisation has also not spared the food production system. The changing trends of population, urbanization, poor production practices and climate change have caused a considerable shortage in fertile arable land. As land resources decrease, policy makers are coming up with solutions to feed the increasing population. Some of the solutions for improving future food production systems include; urban vertical farming, and smart agriculture, which is a combination of Internet of Things (IoT), smart connected devices, and precision farming techniques, all these strategies involve great use of technology and automation (Sarni, et al., 2016).

Significantly, high tech farming techniques and technologies have already started becoming common place among farmers. The farmers have started employing these techniques in order to improve the efficiency of their daily activities on the farm. Sensors for instance are placed in fields so that farmers are able to obtain detailed maps of the topography and the resources in

the farm area, as well as other necessary variables such as the acidity and the temperature of the soil. Farmers can also use these sensors to predict the weather patterns in the coming days and weeks, to help them determine whether they can run their planned farm activities according to the weather (Meola, 2016).

Another key technological innovation in farming is the Internet of things (IoT), this is a technology that involves the use of data to inform farmers about the efficient and effective ways associated with the environment as well as its social benefits. These technologies allow farmers to monitor their crops and also to enable them to make informed decisions that can be effective and increase productivity with reduced impacts to the environment (Sarni et al., 2016).

#### 2.5.1.3 Changing Consumer Food Demands

Technology on the other hand continues to play a huge role in the food system and mostly in the relationships between farmers, the food system and agribusiness firms. One of the technologies that has emerged over the years and which is becoming more relevant is Biotechnology. Alternatively, biotechnology is also used for creating farm products, however the challenge has been for the consumer to accept such products because biotechnology has been creating Genetically Modified Organisms (GMO) and non-GMO. 'A genetically modified organism, or GMO, is an organism that has had its DNA altered or modified in some way through genetic engineering. In most cases, GMOs have been altered with DNA from another organism, be it a bacterium, plant, virus or animal.' GMO's have a lot of benefits and some of the potential benefits include; foods taste better, the products are more nutritious and crops are resistant to diseases and droughts (Lallanilla, 2016).

Further, biotechnology also offers the potential to create new food markets that may satisfy the demand for greater nutritional value in foods from consumers. These include foods that have improved nutritional content such as bread and cereals that are vitamin enriched, calcium-enriched juice and milk, these foods contain more calcium than the regular milk. Biotechnology has the ability to change the content of foods, by either enhancing certain nutrients or reducing the less desirable traits such as fat or cholesterol or creating new traits for example foods with higher shelf life. It is however the consumer's choice on whether they should consume such products or not, as such the success of foods altered by technology to flourish on the market is dependent on the consumer's choice. Such factors also affects the food demand. Biotechnology also plays a great role in production practices at the farm and also

builds the relationship between farmers and other players in the food-marketing channel (Lallanilla, 2016).

Technological change will also continue to affect the food system through information technology. The changes in computer, telecommunications, and satellite technology will continue to reduce the costs of collecting, analyzing, and sharing of information between the consumers and the suppliers. Similarly, relations will continue to change between farmers and food firms. Members of the agri-food channel with knowledge on customer buying habits, primarily retailers and food service industries, will play a greater role in dictating production and processing decisions designed to meet end consumer demands. At the other end of the food system, information about production methods will provide value and a competitive advantage to the party that is able to maintain the property rights of such information.

Moreover, technological change has the ability to enlarge the opportunity for a consumer to be able to directly supply their products through the Internet and other mass mailing or other delivery methods besides going through the retailer to get to the end of the food system. It is believed that easy access to information about a product increases the demand of that product and also improves the relationship between the consumer and the supplier as such technological changes play a huge role on the market and will ensure that consumers easily get the right type of information that they require before purchasing them.

#### 2.5.1.4 Drivers of Change

Changes in the structures of agricultural production and in industries associated with agriculture in the food system and market players (from input suppliers to retailers) are being driven by economic and social changes which farmers or other players in the food system cannot control. It is important to examine some of the drivers of change that are affecting the food system and identify how they affect the different players of the food system. Environmental changes caused by agricultural production, urbanization and industrialization have the ability to impact the global food system negatively, by reducing the quality and the size of land and available water resources (Schweikhardt & Whipple, 2001).

Understanding the population trends and demographics is critical to estimating the future of the food system. It has been projected that population will increase between 8 to 10 billion by 2015 and the most growth will be realized in developing country. According to Lutz and Samir (2010) population growth is one of the major drivers of change in relation to food security at

global level. Therefore, in order to feed approximately 9 billion people by 2050, food production has to increase or even double.

Secondly, increase in the population growth also increases the economic growth, in other words as population grows wealth also increases. When wealth improves in terms of per capita income, food composition will increase and change. When income increases, consumers want certain changes and this results in choices of food that are appropriate with their earnings. According to Lundqvist (2006), higher income results in choices of food that require more water to be produced per unit.

When the population increases the demand for aquatic products such as fish and shrimp also increase. This further increases the demand for freshwater resources. Hence, more water will be required as the population increases. In the near future, changes in income will have a great impact on the demand for food production, food security, and also the availability of water to be used to produce food (Tilman et al., 2011).

A third driver of change in the food system is the international integration of markets. Trade is another essential factor in the food system. For instance, a larger volume of food is exported in the U.S, this trend is expected to increase since consumer demands for more variety and great quality, along with the existence of more open markets, both of these will rise simultaneously. When this is the case the markets are improved and put in a better position and they assist in the food system at an international level in the scope of the food marketing channel. As markets become incorporated across national borders, new policy issues arise and old policy issues gain new dimensions that make policy decisions more complex. A commodity program has a huge impact on imports and exports because it becomes an important consideration for policy makers and it also affects exchange rates and macroeconomic policy (Schweikhardt & Whipple, 2001).

#### 2.5.1.5 Innovation and Technology

So many technologies related to agriculture have been developed and some technologies are still underway. These technologies will enable farmers to deal with the predicted changing demand for food, produce quality products and also reduce the post-harvest losses. Some of the technologies that have been developed include; sensors, robots, automation and big data which are commonly known as smart agricultural technologies.

Sensors have been developed to enable traceability and diagnosis of crop, livestock and farm machine states. There are different types of sensors with specific functions**.** Sensors are placed on vehicles or aerial platforms such as drones and they determine clay, organic matter, PH

levels and the moisture content of the soil. Sensing technologies provide data that can be processed and interpreted as need be to optimize yield. The data is used for monitoring yield on the farm, whereby systems are placed on harvesting vehicles and they provide a crop weight yield by time, distance and GPS (Anthony, 2017).

The sensors are also used to measure variable rate of fertilizer, application tools use yield maps and optical surveys to determine the health of the plant determined by the coloration of the plants. These controllers mainly control the amount of fertilizer, granular, liquid and gaseous fertilizer materials.

Smartphone sensors and apps allow farmers to take advantage of smart agriculture technologies and they have begun to integrate Internet of Things (IoT) features. The camera of the smartphone for instance provides pictures of healthy looking leafs, chlorophyll measurement, ripeness level and it also measures soil organic and carbon makeup. The GPS of the smartphone provides location for crop mapping, disease/pest location alerts, solar radiation predictions and fertilizing (Steven, 2018).

In addition to that, IoT technologies have the ability to improve the nutritional content of food, for example, it is possible to produce lettuce with less potassium content, and lettuce usually has 80% of potassium which is unhealthy for people on dialysis to consume. A hardware sensor is one of the of technologies that is used to collect data, the data collected throughout the building is used to adjust light, climate and other conditions that are needed to grow potassium with less potassium content.

IoT is also used to improve the care and herd productivity of livestock. This is done by attaching sensors to daily cows to spot illness earlier, in order to reduce livestock illnesses and to increase milk yields. Individual ill animals are identified and treatment is provided to those specific animals, this prevents other animals from contacting the disease and also keeps the animal in perfect health. This approach is beneficial to the extent that it reduces herd-wide vaccines of antibiotics.

According to the Food and Agriculture Organization of the United Nations, 20–40% of global crop yields are estimated to be lost each year to pests and diseases, even after the application of pesticides. Devices such as robots and drones have been developed to reduce the chemical use by identifying crop pests and diseases at an early stage of development, so that the affected plants are removed and chemicals are applied before a lot of damage is done.

Modern technology has the capacity to eliminate pests without damaging the wildlife. According to the researchers at the University of Sydney's Australian Centre for Field Robotics, targeted spraying of vegetables uses less of the volume of the chemical than when the herbicide was sprayed on the whole field. These methods are believed to be a more efficient way for production, with minimized costs of production.

There have been many arguments on whether biotechnology contributes to food security or not. Claims and counter-claims have been made about this phenomenon especially in developing countries. With the growing population and land shortages there is an urgent need to increase output, yield and agricultural globalisation is viewed as the potential solution to solve the existing problems. Others counter-argue with this idea by pointing out the idea relating to distribution than the actual availability of food which is the main issue. Others have also argued that not all agricultural biotechnologies work in some agro-ecological zones that implies that a lot of money is spent on research and development and yet some areas do not benefit from such technologies (Scoones, 2002).

#### 2.5.1.6 Changing Institutions and Governance

In order to improve agricultural productivity and reduce rural poverty, hunger and malnutrition, stable institutions and good governance are necessary. “Governance refers to how power and authority are used to manage the collective affairs of a community, society, nation, or country (IFPRI, 2014). Institutions are the systems of formal and informal rules that enable the development of policies, cooperation, and innovation. Strong institutions allow for more effective management of common pool resources and environmental services, strengthened assets and property rights; inclusive and effective collective action; pro-poor public investments and policies; and high-quality public service delivery while good governance facilitates technical dynamism, gender equity, risk mitigation, and inclusion of the poor in shared growth” (IFPRI, 2014)

Countries are investing in land and property rights projects because of the critical role that land, natural resources and other property assets play in economic development, thus it is very essential to have sound institutional arrangements into play. These projects empower the poor and strengthen the investment climate for firms by helping improve access to land for productive use.

Alternatively, there is need for more inclusive and efficient food and agricultural systems, because global challenges are changing and so are their solutions. Developing countries’ food

systems are changing rapidly, this is being characterized by analysing how integrated supply chains are increasing rapidly and becoming more global and complex, and agricultural markets are also increasingly becoming integrated. The demand for processed food products with higher nutritional values is also constantly increasing, this is so because of the higher per capita income and urbanization levels (FAO & UNIDO, 2009).

Notably, these changes create opportunities for all the actors in the agriculture sector. In light of this, recent developments have yielded positive results that means improving the efficiency of such systems in the sector will ensure that the available natural resources are being used responsibly, will improve incomes, reduce food losses and waste and will promote the delivery of products that are healthy and safe for consumption.

However, the development is not in favour of the participation of smallholder producers, women, young people and small countries in local, national and global markets, because they lack the capacity to be competitive and attractive on the global market due to financial constraints and lack of technical know-how to satisfy their consumers and also to certify their products. Much as it is solely true, the world is changing very fast and access to information technology is also improving rapidly, that means that the producer will not remain at the same level for long. Hence, promoting the participation of these groups and countries in food and agricultural systems is critical to achieving the global goal which is to have a world without hunger.

### 2.6 General Arguments

Globalisation has many dimensions which affect different aspects of the economy. Some of the structures that are affected by globalisation include: markets, government policies and resource availability in developing countries. Furthermore, globalisation also affects actors at different levels either domestically or internationally. These changes in turn have different implications on the food and agricultural sector and rural areas (Diaz-Bonilla & Robison, 2001).

Globalisation also affects income distribution and economic assets. These dimensions may empower or disempower the poor if not handled correctly. The main issue of food security is the lack of access due to poverty. Availability and access represent the utilization of food; therefore, a poor person does not easily access food that means that they cannot also utilize the food (Diaz-Bonilla & Robinson, 2001).

Trade liberalization is the main component of globalisation. According to Diaz-Bonilla and Robinson (2001), globalisation improves food security. Over the years, food availability has improved in most developing countries and there has been an increase in per capita calories. In addition, the number of malnourished children has declined. On the contrary, even though food insecurity has declined in most developing countries, Sub-Saharan countries still face the problems of insecurity (Diaz-Bonilla & Robinson, 2001). The poor population in rural areas lack access to information, markets and access to technologies. These constraints limit the poor from competing on the markets and the profits obtained from their sales. Agricultural technologies have shaped the food systems in most countries, but the world majority still do not have enough food and are still in dire impoverishment (Diaz-Bonilla & Robinson, 2001).

Trade liberalization, WTO negotiations, protectionism, subsidies and domestic support also affect agricultural production and exports in developing countries. Developing countries depend on agriculture for their GDP and the majority of exports are from agriculture. Limited farmer's resources lead to increased food insecurity and worsened income distribution. Food security is also believed to worsen because cash crops would replace staple foods. Studies have shown that the green revolution has a positive impact on food prices, production and employment (Scoones, 2002).

Trade liberalization is the key driver of globalisation and is regarded as the step to achieving trade openness (Feenstra & Taylor, 2008). Many debates have arisen concerning the benefits and disadvantages of agricultural trade liberalization to rural farmers. Agricultural trade liberalisation is the process of reducing existing trade barriers which have been created by countries around the world to protect domestic agricultural production from foreign competition (Feenstra & Taylor, 2008).

Edwards (1998), found that trade openness leads to increased productivity through technological changes. The increase in productivity that results from improved technologies then promotes growth. Roberts (2000), argued that globalisation promotes increased diffusion of technology, knowledge and increased investment. These factors also lead to the improvement in productivity and growth. Furthermore, he found that trade improves allocative efficiency, specialization and increased exports. As a result of increased exports, a country witnesses increased demand for manufactured goods, greater domestic production and increased employment. Increased trade also improves the standards of living and the improvement of life in general (Pretorius, 2002).

Trade liberalization and regional integration are also beneficial to improving food consumption, household food security and foreign income earnings (Robinson & Thierfelder, 2002). Global expansion in agricultural trade and finance is also important because it reduces fluctuations in food supply. The implication of this is that countries will be enabled to import food at stable prices. Improvement of market access in developing countries promotes agricultural exports which affect foreign exchange and food imports. This in turn also improves income levels among poor farmers and in return improve food amounts by lowering food prices (Diaz-Bonilla & Robinson, 2001).

According to Stiglitz (2002), most world leaders have expressed concern that globalisation is not making life better for those that most need it. Even though many poor people have not benefitted from globalisation, the opening up to international trade has helped many countries. Trade helps economic development when a country's exports drive its economic growth. Globalisation has made many people better off by opening up employment opportunities and has also given many people in developing countries access to knowledge. Even though globalisation has some negative consequences such as hurting local market players, the benefits outweigh the negative sides of it, because it means that the consumers purchase the goods cheaply. New foreign firms can harm the protected state-owned enterprises, but they can also lead to the introduction of new technologies, access to markets and the creation of new industries (Stiglitz, 2002).

Foreign aid which is another form of globalisation has also brought benefits to a lot of people in the developing countries. For instance, jobs which are provided by World Bank projects, irrigation projects have doubled the incomes of farmers, education projects have brought literacy to rural areas while AIDS projects have helped contain the spread of the deadly disease. All these advantages stated are beneficial to food supply, therefore globalisation is seen to have more benefits than the mentioned negative impacts (Stiglitz, 2002).

### 2.7 Other Studies on Globalisation and Food security

The findings on the impact of globalisation on food security show mixed results. Some findings show a significant impact while others show that the impact is both positive or negative.

Sartori and Schiavo (2015) used network analysis to investigate the impact of globalisation on adverse shocks in food production. Their study used a food production and international trade data set from FAOSTAT database with data ranging from 1986 to 2010, the data also

comprised of 253 countries. The study established that that increased globalisation is not associated with the increased frequency of adverse weather shocks in food production.

Young (2004), used a novel approach to answer questions on the impact of globalisation on food security. The study established that globalisation has both positive and negative impacts. Globalisation has a positive impact on food security by ensuring sufficiency, and that it contributed to improving access to safe and nutritious foods for all. However, globalisation had a negative impact in some parts of the world because of nutrition issues such as obesity. Young (2004) concluded that purposeful interventions have to be implemented to promote food security.

Dithmer and Abdulai (2017) used the two step Generalized Method of Moments (GMM) approach to investigate the impact of trade openness and other factors like globalisation on food security. The study used a panel data set consisting of 151 countries for periods ranging from 1980 to 2007. The results revealed that trade openness has a positive and significant impact on food security and that it also improves dietary energy supply, diversity and the quality of the diet which are vital indicators of food security. Besides, the study also established that economic and agricultural development, good domestic policies also impact food security positively.

Narayan and Gulati (2002) investigated the impact of globalisation on smallholder farmers using a literature survey approach. In their findings they established that the while some smallholder farmers have benefited from the globalisation wave, other smallholder farmers have not benefitted from globalisation. The impact is different in different regions. Smallholder farmers in Latin America have benefitted more from globalisation than the other regions in Africa and Asia.

Vepa (2004) in a case study, investigated the impact of globalisation on food consumption of Urban India from 1991 which was the year that marked the beginning of globalisation in India. The study focused on finding the link between globalisation and food intake, and the results showed that globalisation increased consumption of high calorie foods which led to high obesity prevalence.

In a case study by Fajardo (2004), which was aimed at investigating the impact of globalisation on food consumption, health and nutrition status in Colombia, it was established that globalisation has improved food consumption patterns through increased food production and the modernisation of agriculture. The study examined the indicators of globalisation from 1990,

which was the year that the government of Colombia made some significant changes in its economic policies, political system and adopted market liberalization. Agricultural reforms were also included and the focus for the agricultural sector was on elimination of government interventions on control of imports and prices for main crops. The study showed that for the period of globalisation agricultural production improved for most crops and livestock while other crops remained stable. Domestic production for instance, increased steadily from the period of introduction of globalisation.

### 2.8 Applied Studies using the Autoregressive Distributed Lag (ARDL)

Kavinya and Phiri (2014) used an ARDL Model to explore the response of maize producers to changes in price and non-price incentives in Malawi. The aim of their study was to assess the maize hectarage response of farmers to price and non-price incentives in Malawi. Their study used a data set of the period 1989 to 2009. The findings from the study showed that the decision to allocate land to maize is dependent on lagged hectarage, labour and available inorganic fertilizers. The study established that price incentives only cannot determine the decision for the hectarage allocated to maize production, because other than prices, farmers are also constrained by land, labour and available inorganic fertilizer .

Salahuddin et al. (2019) used the ARDL Model to investigate the effect of globalisation and corruption on poverty in South Africa. The study used time series data for the period 1991 to 2016. The study used three indicators to measure poverty and the new globalisation index from the Economic Swiss Institute to measure globalisation, and corruption was measured by the newly developed corruption index. The results for this study indicated that globalisation has a positive impact on poverty reduction, while corruption amplifies poverty.

Shahbaz et al. (2015) used the ARDL Model to examine the effects of globalisation on environmental quality in India. The study used annual data for the period 1970 to 2012 and set to explore the relationship between globalisation, carbon dioxide emissions, financial development and economic growth. Unit roots tests were employed to examine the stationary properties of the variables in the presence of structural breaks. Cointegration method was used to establish the long run relationship. After establishing the presence of a cointegration relationship, the results of the long run estimates showed that the acceleration of globalisation leads to the increase in carbon dioxide emissions. Besides that, financial and economic growth both contribute to the degrading of the quality of the environmental by increasing carbon emissions in the long run.

Ojo (2018) conducted a study to find out the impact of globalisation on agricultural productivity in Nigeria. The study used an ARDL Model to analyse annual time series data. The data period was from 1986 to 2015. The findings indicated that globalisation and other variables that were included in the model such as openness and foreign exchange were not significant and did not have an impact on agricultural productivity.

Yusuf (2015) used an ARDL model to investigate the impact of foreign direct investment on agricultural output. The findings from the study indicated that foreign direct investments have significant positive impacts on agricultural output.

### 2.9 Justification of the ARDL Model

The ARDL model was selected as a suitable model for this study because it has better properties than other time series techniques.

The ARDL model is a time series technique that allows the dependent variable to be a function of the current and lagged values of not only itself but also values of other variables included in the model (Greene, 2008). Unlike other methods that were used to analyse the impact of globalisation on different variables, the ARDL model is superior to the other econometric techniques in small sample sizes and the results from the ARDL models are unbiased (Sarkodie & Owusu, 2016). In addition, the ARDL model produces reliable estimates even when the variables have different orders of integration which is an important characteristic that other time series models do not exhibit (Nkoro & Uko, 2016). The ARDL model is also more suitable for the current study because it is suited to capture short run and long run coefficient estimates based on a single equation specification which reduces estimation errors, necessary for unbiased and reliable estimates.

There are different time series techniques such as Engle-Granger, Johansen's and single equation models such as Dynamic Ordinary Least Squares (DOS) and Vector Error Correction (VEC) models which can be used to estimate long run and cointegration relationships among variables. However, these variables require that the variables should be of the order I(1) or I(0). ARDL models have favourable properties because of their ability to estimate cointegration relationships with variables at different levels of integration, i.e. a combination of I(0) and I(1) (Pesaran & Shin, 1998).

Furthermore, ARDL models have different number of lag terms without requiring symmetry lag lengths. ARDL models also provide long run estimates even when some endogenous

variables behave as regressors (Sarkodie & Owusu, 2016). The ARDL model is able to trace relationships among the variables in the short run and over time thereby being an attractive model in testing the possibility of co-integrating relationships among the variables (Pesaran, Shin & Smith, 2001).

### 2.10 Summary and Conclusion

This chapter has provided information on the work that has already been done on the impact of globalisation on food security. The chapter also presents the theory behind globalisation, its subcomponents and a general description of food security and its indicators. The findings from the review of literature indicate that the impact of globalisation is mixed. Some studies show that globalisation has a positive significant impact while other results show that globalisation has not impacted food security but instead has introduced other nutrition problems such as obesity.

Further, the chapter also summarised studies that have used other approaches to investigate globalisation impacts. In addition, different studies that used ARDL models have also been included in the section. The chapter also included the justification of the choice of model, of which some of the reasons for selecting the ARDL model as the suitable model for the study are that unlike other time series models, the ARDL model is superior to other econometric techniques in small sample sizes and that the results from the ARDL models are unbiased. The ARDL model also produces estimates that are reliable even when the variables have different orders of integration which is an important characteristic that other time series models do not exhibit.

# CHAPTER 3: BACKGROUND ON MALAWI

## 3.1 Introduction

This chapter provides in detail the background information and the country profile of Malawi. Furthermore, the chapter gives a description of the position of Malawi in terms of food production, trade agreements and agricultural trade trends.

Malawi is a landlocked country and does not have an advantage when it comes to location. This chapter provides in detail the macroeconomic performance of Malawi, trade regulations, FDI and trade data in general. The wealth of information provided in this chapter explains the position of Malawi in sectors that are related to this study such as the agricultural sector by examining production data over the years and trade data in terms of imports and exports and the member states with whom Malawi trades. The data also portrays how trade regulations have evolved over the years. From the data it is without doubt that globalisation has contributed to expansion of trade of different crops and commodities in Malawi.

## 3.2 Country Profile

Malawi is located in southeast Africa. To the north of the country lies the neighboring country of Tanzania; to the central west Zambia; while Mozambique is on the southern and central eastern side of the country.

The country on average has an annual rainfall of 1,181 mm and a vast amount of water in Lake Malawi. Malawi has a tropical to temperate climate. The country has more than 17 billion cubic meters of renewable water available, 5 million of which are collected every year. Approximately 84% of the total water obtained each year is used in agriculture (FAO, 2013).

The last census in 2010 estimated the population at 14,900,841 and was stated to be increasing by an average of 3.1% per annum. Of this, nearly 80% is classified as rural (FAO, 2012). The population is spread across Malawi's three regions: northern, central and southern. The bulk of this population is involved in farming or some form of agricultural output. Among the farmers, most are subsistence farmers which account for about 97% of the farmers and 3% are large farm holders which represent the estate sub sector. Small scale farmers contribute 70% to the agricultural GDP and less than 30% comes from large farm holders.

Malawi's economy is predominately agricultural driven. The agricultural sector remains the most important sector in the Malawian economy, accounting for about 28% of Gross Domestic Product (GDP) and 85% of employment and producing about 83% of foreign exchange

earnings. In terms of food, the sector also helps about 85% of the population. Major exports from Malawi include tobacco, sugar, tea, cotton, peanuts, dried legumes, coffee and soy. Tobacco is the most exported product and it accounts for 55% of the share of all exports. Maize is the most produced product and it is Malawi's staple food, and accounts for a significant proportion of agricultural production. Other significant crops produced in Malawi are potatoes, cassava and tobacco.

Most of the products exported from Malawi go to South Africa, United States, Germany and the smallest portion goes to Netherlands. The largest portion of Malawi's imports come from South Africa, then from Zimbabwe and the smaller portions come from Zambia and Japan.

### 3.3 Agriculture's Contribution to GDP and Related Issues

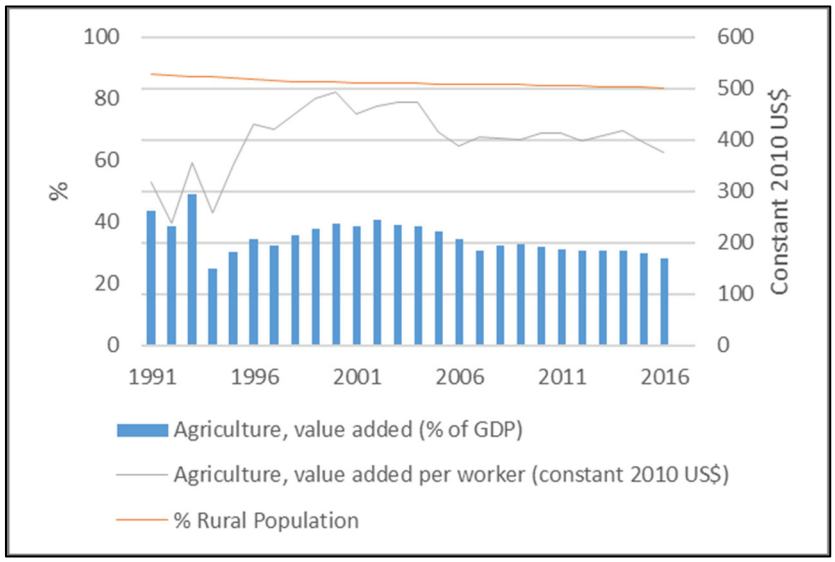
The importance of agriculture in the economy of Malawi and other countries is measured as the value added of the agricultural sector as percentage of GDP. Generally, agriculture's contribution to GDP is a measure of the development status of a country as resources move from the agricultural sector into manufacturing.

Malawi's agricultural contribution to GDP is shown in Figure 3.1. The level starts at 44% in 1991 before declining in 1992 to 39%, the decline in this year was due to the drought that hit Malawi in 1992. In 1993, it rose back to 49% which has been the highest share that agriculture has contributed to GDP since 1991 till present. Another decline in the GDP is noted in 1994, dipping to a low of 25%; the decline was also due to a drought that hit Malawi in 1994. Since 1994, GDP has been fluctuating ranging from 30% in 1995 to 28% in 2016.

The graph also shows that most Malawians live in the rural areas, as of 1991, 88% of people were living in the rural areas, until recently whereby the number of people in the rural areas has started to decline steadily. By 2016 the share of the population classified as rural had declined to 84%.

Malawi's agriculture value added per worker has fluctuated substantially in recent years, notably it has declined through 1997 to 2016. From 1996 to 2004 it is noted that there was an increase in the agriculture value added per worker; from 1996 to 2004 a range of $431 to $492 was attained. However by 2016 the value added started to decline; as of 2016 the value added was $376.

***Figure 3. 1 Agriculture Value Added as % of GDP, Value Added per Worker (Constant 2010 $) and % Rural population***

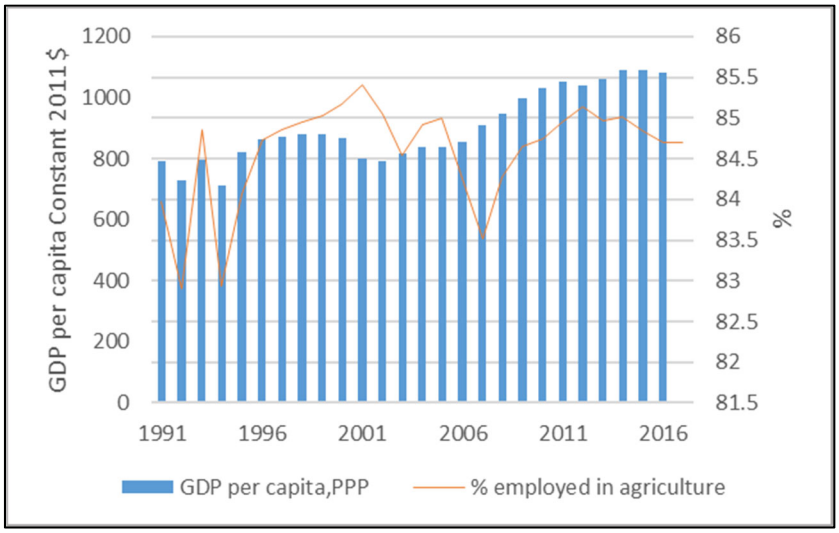



Source: Author's own graph using data from World Bank Development Indicators (2019) and FAOSTAT (2019).

Figure 3.2 completes the macro picture of Malawian agriculture. The graph shows the percentage that are employed in agriculture and the estimates of GDP per capita as a measure of Purchasing Power Parity (PPP). Notably, there has been an increase over the years in the GDP per capita. The highest GDP per capita is recorded in 2016 as $1084. Malawi experienced a decline in the GDP per capita between 2000 and 2006, since then it started to increase steadily.

It is noted that the percentage of those employed by agriculture has been fluctuating over the years, however within the same range. From 1961 to 2016, it is observed that the lowest percentage of employment was 84% and the peak was at 85% in 2001, these are figures in the same range of value that means that for a long time the percentage of those employed by agriculture has been very high in Malawi.

*Figure 3. 2: GDP Per Capita (PPP Constant) and Share of Employment in Agriculture*



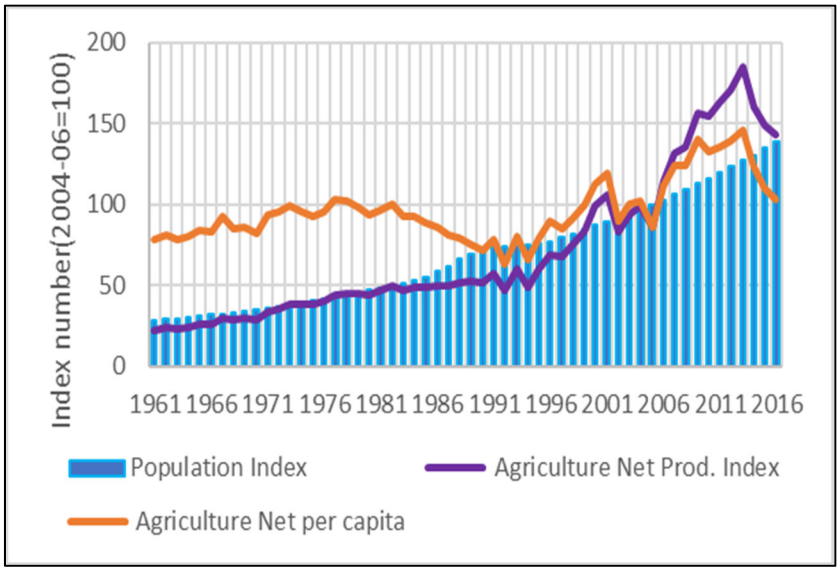

Source: Author's own graph using data from World Bank Development Indicators (2019)

### 3.4 The Performance of Agriculture

The essential role of agriculture is to provide food, tradable goods and employment for a country's population. Key indicators of the performance of agriculture are net agricultural production and net agricultural production per capita. Figure 3.3 shows these indices with a population index to demonstrate the shift relative to the population changes. The base years for the indices are 2004 to 2006.

Examining the net agricultural production, net agricultural production per capita and the population index, we note that agricultural production rose steadily and the peak was in 2013 whereby an index of 185 was recorded. A decline is noted in the years 2014 to 2016. There has been a fluctuation of the trend for per capita production, the highest per capita production was attained in 2013 at 146, but by 2016 the value had declined greatly to 103. Population in Malawi has been increasing since 1961 until 2016 at a rapid trend, as the years have passed by, population has also increased greatly.

*Figure 3. 3: Net Agriculture Production and Per Capita and Population Index*




Source: Author's own graph using data from FAOSTAT (2019) and World Bank Database (2019)

### 3.4.1 Agricultural Production

In this section the data is drawn from the Food and Agricultural Organization (FAO) database. Table 3.1 shows the top 20 items produced in Malawi since 1961. It also shows the total production for these items in the last 5 years of data (to 2016) and indicates the last 5 years' production as a share of the total production.

Maize is clearly the most important product, valued at $11,830,000, potato is the next most important product, and potatoes are valued at $7,980,000. This is a reflection of the nature of the primarily Malawian agriculture sector. Maize is Malawi's staple food and accounts for a significant proportion of agricultural production.

The value of the most recent 5 years as a percentage of the total production gives a good indication of the products' importance over the past 50 years. There has been a decline in the amount of tobacco produced, fruits, vegetables and rice. It is important to note that there has been a decrease in the amount of tobacco produced due to the reduced demand from its export destinations, to the point that Malawi is looking to diversify away from tobacco to other cash crops. Pig production has increased greatly more than all the products, one of the contributing factors for this rise is the promotion of the national livestock policy, good management practices including disease control and vaccination resulting into more births than deaths.

***Table 3.1: Malawian Top 20 Agricultural Production 1961-2016 ($ 1000)***

| *Product* | *Total (1961-2016)* | *Total (2012-2016)* | *2012-2016 as % of total* |
|---|---|---|---|
| *Maize* | 11,829,539 | 1,922,084 | 16% |
| *Potatoes* | 7,984,389 | 1,555,679 | 19% |
| *Cassava* | 7,334,758 | 2,570,218 | 35% |
| *Tobacco* | 7,105,641 | 855,615 | 12% |
| *Groundnuts* | 3,808,835 | 698,211 | 18% |
| *Fruit etc* | 3,387,129 | 400,383 | 12% |
| *Sugar cane* | 2,791,625 | 472,359 | 17% |
| *Bananas* | 2,601,713 | 583,121 | 22% |
| *Cattle* | 2,544,232 | 510,885 | 20% |
| *Pigeon peas* | 2,394,641 | 641,446 | 27% |
| *Beans* | 2,186,480 | 396,992 | 18% |
| *Plantains* | 2,118,824 | 398,410 | 19% |
| *Tea* | 1,988,864 | 245,211 | 12% |
| *Vegetables* | 1,658,888 | 207,141 | 12% |
| *Pig* | 1,624,044 | 643,816 | 40% |
| *Mangoes etc* | 1,454,190 | 373,671 | 26% |
| *Goat meat* | 1,088,595 | 382,652 | 35% |
| *Cotton* | 1,045,969 | 384,170 | 37% |
| *Chicken* | 899,148 | 161,727 | 18% |
| *Rice* | 889,601 | 151,850 | 17% |

Source: Author's own computation using data from FAOSTAT (2019)

### 3.5 Trade Reforms in Malawi

Malawi's economy has gone through tremendous changes over the years. Annual GDP growth has peaked to 9.5% with a decline in 2012. The total merchandize trade has also increased from 60% in 2010 to 102% in 2014. The increase in the ratio indicates an increased openness of Malawi's economy. Malawi's exports have increased from $879 million in 2008 to $1,342 million in 2014. Agriculture exports dominate the share from 90% of total exports in 2008 to 73% in 2014. Malawi is a least developed country and it is an agricultural economy; therefore, the economy is easily affected by weather shocks and changes in trade terms (WTO, 2016).

The cost of doing business in Malawi is high due to challenges such as transportation, communication, energy and administrative barriers. This has an impact on Malawi's competitiveness on the world market and also leads to low quality foreign direct investments, making Malawi a country with few foreign investments.

Agricultural exports continue to dominate; however, the share has been declining. Tobacco is the largest export commodity, but the share has decreased from 67% to 47% in 2014. Other

crops are still of relevance such as tea, sugar and uranium. Imports are largely dominated by manufacturers. Malawi exports the bulk of its products to other African countries and the EU, while imports are sourced from South Africa, Mozambique, India, the EU and China (WTO, 2016).

Malawi launched many trade facilitation initiatives including opening of one stop border parts, enhancement of the COMESA simplified trade agreements. Malawi maintains preferences under bilateral trade agreements with Mozambique, South Africa and Zimbabwe and customs agreement with Botswana. Bilateral preferences have been matched by the preferences provided by COMESA and SADC (WTO, 2016).

Malawi has bound 31.6% of its tariff lines at ad valorem rates ranging from 20% to 125%, on 6 tariff lines, Malawi applied rates exceed the corresponding bound levels by 75%. The simple average applied MFN tariff in 2015 to 2016 was 12.7% down from 13.1%. The tariff comprises eight bands: zero, 5%, 7.5%, 10%, 20% and 25% (WTO, 2016).

Malawi applies no tariff quotas and agriculture remains the most tariff protected sector. The average applied tariff on agricultural products according to WTO definition is 18.8% whereas average non-agricultural products is 11.6%.

Malawi maintains licencing requirements and a system of trade permits for importation and exportation of certain goods. Importation and exportation of agricultural products requires both a trade permit and a licence (WTO, 2016). Malawi became a member of WTO in 1995, it is part of regional and preferential agreements and grants duty free market access to products that come from COMESA region. Malawi joined countries that form the COMESA customs union, which was formed in June, 2009 (WTO, 2016).

Malawi also takes part in many initiatives which are aimed at promoting trade among the member states such as Regional Customs Bond Guarantee Scheme, COMESA simplified trade and it is also part of the COMESA protocol on trade in services and participates in a number of COMESA institutions. Malawi is also a member state of Southern African Development Community (SADC). Being a member of SADC has helped Malawi find its way in liberalization of intra community trade in goods with exceptions in the free trade area. In addition, SADC supports its member states in international and regional trade. In June 2011, the SADC, COMESA and East African Community (EAC) formed a free trade area negotiation with the aim of improving integration processes. The initiative also enhances easy trade and transportation among the 26 member states (WTO, 2016).

Malawi also has preferential treatment from the Generalized System of Preferences (GPS) from Australia, Canada and Eurasian Economic Union, European Union, Iceland, Japan, New Zealand, Norway, Switzerland, Turkey and the United States. Malawi in its least developed state qualifies for preferential market access to China, Chile, India, Morocco, Thailand and Korea. Malawian exports of certain agricultural products are eligible till 2025 for duty free and quota free to the United States under the African Growth and Opportunity Act (AGOA). Besides that, Malawi also participated in the launch of negotiations on Continental Free Trade Area in June, 2015 (WTO, 2016).

### 3.5.1 Foreign Direct Investments

Foreign Direct Investment in Malawi is still limited, but has increased in recent years. Malawi's total FDI stock was at $1,239 million in 2014 which is 30% of GDP from $1,165 million in 2011. The leading investors include Switzerland, South Africa, United Kingdom, Kuwait, Mauritius and France. FDI inflows go into mining, agro-processing, energy, railways and construction while outward FDI remains very limited (WTO, 2016).

## 3.6 Malawian Agricultural Trade

### 3.6.1 Malawian Agricultural Exports

In this section agricultural trade data is presented from two sources. The first is a series from 1961 to 2013 from the FAO using FAO 'items' or products. The second source is from the International Trade Commission (ITC) which provides data from 2001 through to 2017. The ITC provides more specific details on destinations and sources of trade. The ITC uses the Harmonized System (HS) classifications for trade lines, and this internationally accepted trade classification system is not directly comparable with the FAO 'items' although concordance tables are available. An aggregation of trade lines in the ITC data that closely resembles the WTO definitions of agriculture (HS 01, 02, 04-24, 41, 51 & 52), are used while the FAO definitions differ. For these reasons the two sources are not directly comparable.

Table 3.2 shows the historical pattern of Malawian agricultural export products by FAO items. The data is expressed in a percentage of the total of the last 5 years and the total of all the products from 1961 to 2013. Looking at the column for share of the totals it is noted that beans had the highest share (79%), followed by natural rubber (47%) and coffee with the lowest share.

***Table 3.2: Malawian Agricultural Export Products by Value: 1961-2013 ($Million )***

| *Item* | *Total (1961-2013)* | *Total (2009-2013)* | *% of Totals* |
|---|---|---|---|
| *Total Merchandise Trade* | 20,592 | 6,470 | 31% |

| | | | |
|---|---|---|---|
| *Agri. Products, Total* | 17,812 | 5,207 | 29% |
| *Beverages, Tobacco* | 11,673 | 3,253 | 28% |
| *Food and Animals* | 5,059 | 1,496 | 30% |
| *Coffee, Tea, Cocoa* | 2,238 | 475 | 21% |
| *Tea* | 1,936 | 427 | 22% |
| *Sugar and Honey* | 1,724 | 579 | 34% |
| *Crude Materials -Ex2* | 1,062 | 456 | 43% |
| *Fruit and Vegetables* | 566 | 255 | 45% |
| *Oilseeds* | 505 | 223 | 44% |
| *Cereals and Preparations* | 456 | 151 | 33% |
| *Textile Fibres* | 405 | 178 | 44% |
| *Groundnuts Total Shelled* | 396 | 172 | 43% |
| *Pulses* | 380 | 181 | 48% |
| *Cotton lint* | 333 | 131 | 39% |
| *Maize* | 323 | 101 | 31% |
| *Sugar refined* | 198 | 30 | 15% |
| *Nuts, nes* | 142 | 62 | 44% |
| *Peas, dry* | 115 | 76 | 66% |
| *Natural Rubber* | 102 | 48 | 47% |
| *Rice* | 72 | 15 | 21% |
| *Fodder & Feeding stuff* | 57 | 23 | 40% |
| *Beans, dry* | 50 | 40 | 79% |
| *Oilseed Cake Meal* | 36 | 11 | 32% |

Source: Author's own computation using data from FAOSTAT (2019)

The table 3.3 shows a compilation of the key export products and their destinations. Belgium, United States of America, Germany and Netherlands are the key export destinations for Malawian agricultural goods over the period. Furthermore, tobacco is a key export product to all the mentioned key destinations (Belgium, United States of America, Germany and Netherlands), followed by tea to the United Kingdom. The highest percentage of tobacco goes to Belgium.

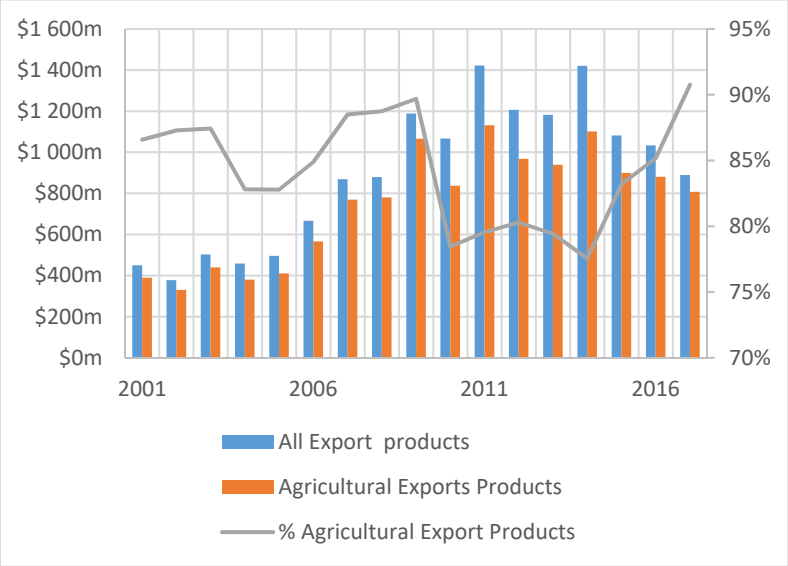
***Table 3.3: Malawian Agricultural Export – Bilateral Exports ($Million) and % Share of the 2006-2010 Period***

| ***Destination*** | ***Item*** | ***Total (1961-2013)*** | ***Total (2009-2013)*** | ***% (2006-10)*** |
|---|---|---|---|---|
| *Belgium* | Tobacco, raw | 766 | 567 | 74% |
| *USA* | Tobacco, raw | 574 | 177 | 31% |
| *Germany* | Tobacco, raw | 551 | 204 | 37% |
| *Netherlands* | Tobacco, raw | 483 | 170 | 35% |
| *Egypt* | Tobacco, raw | 444 | 288 | 65% |
| *UK* | Tea | 331 | 101 | 31% |
| *Japan* | Tobacco, raw | 302 | 0 | 0% |
| *Switzerland* | Tobacco, raw | 285 | 96 | 34% |
| *UK* | Sugar Raw Centrifugal | 237 | 121 | 51% |
| *South Africa* | Tea | 209 | 122 | 59% |
| *China, mainland* | Tobacco, raw | 201 | 173 | 86% |
| *Russia* | Tobacco, raw | 192 | 119 | 62% |
| *UK* | Tobacco, raw | 166 | 30 | 18% |
| *South Africa* | Tobacco, raw | 151 | 33 | 22% |
| *Zimbabwe* | Maize | 145 | 39 | 27% |
| *Korea* | Tobacco, raw | 143 | 83 | 58% |
| *Poland* | Tobacco, raw | 141 | 77 | 55% |
| *Portugal* | Sugar Raw Centrifugal | 126 | 78 | 62% |
| *Philippines* | Tobacco, raw | 118 | 80 | 68% |
| *Turkey* | Tobacco, raw | 109 | 49 | 45% |

Source: Author's own computation using data from FAOSTAT (2019)

Figure 3.4 shows the ITC data for total exports, agricultural exports and agricultural exports as a percentage of total exports. This allows us to zoom in on recent changes to the agricultural export pattern. As the chart shows, agricultural exports have been fluctuating over the period from 2001, after a steady rise, there is an unstable change in the trend as the agricultural export products increase and decrease consecutively. Share of exports has also been fluctuating over the years. The highest percentage of agricultural products was recorded in 2009 at 90% and the lowest between 2014 and 2015. The percentage was lowest in these two years because of drought that had stricken Malawi in those years. After these two years the percentage picked up and has been constantly increasing over the years.

***Figure 3.4: Malawian Agricultural Exports 2001-2016***




Source: Author's own graph using data from ITC (2019)

***Table 3.4: Malawian Agricultural Export Products to World ($1000)***

| *HS Code* | *Item* | *Total (2001-2017)* | *Total (2013-2017)* | *% of Totals* |
|---|---|---|---|---|
| *'2401* | Tobacco raw | 1,191,800 | 301,098 | 25% |
| *'0902* | Tea | 444,712 | 167,204 | 38% |
| *'1701* | Sugar Cane | 391,749 | 83,541 | 21% |
| *'1202* | Groundnuts | 263,442 | 152,207 | 58% |
| *'1005* | Maize or corn | 246,779 | 17,580 | 7% |
| *'5201* | Cotton | 158,484 | 21,786 | 14% |
| *'2304* | Oilcake | 83,925 | 82,071 | 98% |
| *'2208* | Undenatured ethyl alcohol | 75,134 | 63,884 | 85% |
| *'1201* | Soya beans | 70,699 | 50,297 | 71% |
| *'0407* | Birds' eggs | 69,504 | 68,226 | 98% |
| *'0713* | Dried leguminous vegetables | 56,314 | 28,592 | 51% |
| *'0802* | Other nuts | 54,183 | 29,842 | 55% |
| *'1206* | Sunflower seeds | 53,576 | 3,344 | 6% |
| *'1208* | Flours and meals | 52,504 | 2,499 | 5% |
| *'2302* | Bran | 45,629 | 36,671 | 80% |
| *'2306* | Oilcake | 43,349 | 36,638 | 85% |
| *'1207* | Other oil seeds | 28,526 | 7,991 | 28% |
| *'0105* | Live poultry | 21,698 | 1,312 | 6% |
| *'1101* | Wheat | 21,057 | 205 | 1% |
| *'1006* | Rice | 20,276 | 2,172 | 11% |

Source: Author's own computation using data from ITC (2019)

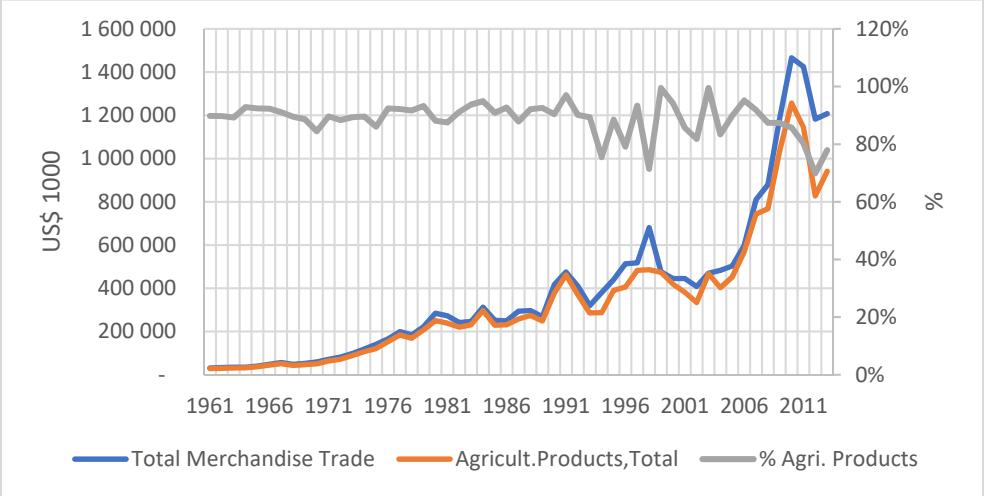
The agricultural exports to the EU are shown in Table 3.5, and here the profile is similar to the global exports in Table 3.4. Tobacco raw, dominated the agricultural export products, followed by tea, sugar cane, groundnuts and maize.

***Table 3.5: Malawi's Agricultural Exports to the EU, ($1000)***

| HS Code | Item | Total | Total (2013-2017) | % of Totals |
|---|---|---|---|---|
| | All products | 5,403,467 | 2,000,517 | 37% |
| | Agricultural Products | 5,274,062 | 1,939,030 | 37% |
| '2401 | Tobacco raw | 3,785,600 | 1,398,419 | 37% |
| '1701 | Sugar Cane | 822,050 | 314,997 | 38% |
| '0902 | Tea | 411,070 | 133,107 | 32% |
| '0802 | Other nuts | 69,918 | 26,730 | 38% |
| '0901 | Coffee | 41,138 | 7,474 | 18% |
| '1703 | Molasses | 25,983 | 23,929 | 92% |
| '0713 | Dried leguminous vegetables | 24,938 | 6,384 | 26% |
| '5201 | Cotton | 24,706 | 13,819 | 56% |
| '0904 | Pepper | 17,934 | 3,936 | 22% |
| '1801 | Cocoa beans | 9,566 | - | 0% |
| '5202 | Cotton waste | 5,933 | - | 0% |
| '0603 | Cut flowers | 5,349 | 3,269 | 61% |
| '1704 | Sugar | 4,892 | - | 0% |
| '1005 | Maize | 4,326 | - | 0% |
| '5203 | Cotton | 2,486 | 2,068 | 83% |
| '1202 | Groundnuts | 2,469 | 30 | 1% |
| '4103 | Other raw hides | 2,288 | 615 | 27% |
| '2402 | Cigars | 1,333 | - | 0% |
| '0710 | Vegetables | 1,094 | - | 0% |
| '1702 | Other sugars | 1,090 | - | 0% |

Source: Author's own computation using data from ITC (2019)

***Figure 3.5: Malawi's Agricultural Exports to the EU ($1000)***




Source: Author's own graph using data from FAOSTAT (2019)

Both merchandise trade and agricultural products have increased over the years, notably the value for merchandise trade has always been more than the value for agricultural products. The trends for Merchandise trade and agriculture has been the same over the years, notably, merchandise trade increased in value; the agricultural product value also increased at a similar trend. In 2010 Malawi had the highest figures in merchandise and agricultural products, the value attained was $1,466,000 and $1,256,705 respectively. After that rise both merchandise trade and agricultural products started to decline from 2011.

Clearly, the percentage of agricultural products has been fluctuating but at a constant trend, the lowest percentage was realized in 1998 and it was at 71% and the highest was in 1999 at 99%, we note that in 1999 there was a sharp increase in the total merchandise while the agricultural products had declined.

### 3.6.2 Malawian Agricultural Imports

The historical pattern of Malawi's agricultural imports is shown in Table 3.6. Since 1961 agricultural imports have averaged 36% of total merchandize imports and the total agricultural products. Wheat dominates the agricultural imports at 70%, followed by soybean oil at 55% and oilseeds at 50%. The least imported products in Malawi include maize (6%), dairy products (24%) and cereals and preparations (31%).

***Table 3.6: Malawian Agricultural Imports ($Million)***

| *Item* | *Total (1961-2013)* | *Total (2009-2013)* | *% of Totals* |
|---|---|---|---|
| *Total Merchandise Trade* | 33,033 | 11,827 | 36% |
| *Agri. Products, Total* | 4,563 | 1,655 | 36% |
| *Food Excl Fish* | 3,383 | 1,123 | 33% |
| *Cereals and Preparations* | 2,044 | 626 | 31% |
| *Beverages+ Tobacco* | 902 | 428 | 47% |
| *Maize* | 839 | 52 | 6% |
| *Tobacco* | 828 | 408 | 49% |
| *Wheat* | 688 | 484 | 70% |
| *Animal Vegetable Oil* | 601 | 249 | 41% |
| *Fixed Vegetable Oils* | 458 | 192 | 42% |
| *Dairy Products +Eggs* | 276 | 68 | 24% |
| *Oil, soybean* | 228 | 126 | 55% |
| *Miscellaneous Food* | 194 | 80 | 41% |
| *Fruit and Vegetables* | 147 | 51 | 35% |
| *Crude Materials -Ex2* | 141 | 60 | 43% |
| *Food prep nes* | 139 | 55 | 40% |
| *Sugar and Honey* | 95 | 34 | 35% |
| *Oilseeds* | 90 | 45 | 50% |

| *Item* | *Total (1961-2013)* | *Total (2009-2013)* | *% of Totals* |
|---|---|---|---|
| *Beverages* | 75 | 20 | 27% |
| *Malt* | 67 | 23 | 34% |

Source: Author's own computations using data from FAOSTAT (2019)

The major bilateral flows are shown in table 3.7, and tobacco from Zambia and Mozambique dominate, followed by maize from the USA, this is followed by soybean oil from Argentina. Wheat has also been imported from 6 different sources namely: USA, Australia, Switzerland, Mozambique, Russia and Arab United Emirates. The least bilateral flows into Malawi include: tobacco raw from Tanzania, food preparation nes from South Africa and malt from Denmark.

***Table 3.7: Malawian Agricultural Import Bilateral ($million) and % of the Totals***

| *Partner Countries* | *Item* | *Totals (1961-2013)* | *Totals (2009-2013)* | *% of Totals* |
|---|---|---|---|---|
| *Zambia* | Tobacco, raw | 350 | 255 | 73% |
| *Mozambique* | Tobacco, raw | 137 | 61 | 45% |
| *USA* | Maize | 121 | 5 | 4% |
| *Argentina* | Oil, soybean | 77 | 57 | 73% |
| *USA* | Wheat | 77 | 66 | 86% |
| *Australia* | Wheat | 75 | 71 | 94% |
| *Switzerland* | Wheat | 73 | 71 | 97% |
| *South Africa* | Maize | 72 | 13 | 18% |
| *Zimbabwe* | Maize | 63 | 1 | 1% |
| *Mozambique* | Maize | 61 | 14 | 22% |
| *South Africa* | Oil, soybean | 60 | 15 | 25% |
| *Mozambique* | Wheat | 54 | 14 | 26% |
| *Russia* | Wheat | 41 | 38 | 94% |
| *Zambia* | Maize | 38 | 19 | 49% |
| *South Africa* | Flour, wheat | 38 | 1 | 2% |
| *Arab* | Wheat | 37 | 12 | 32% |
| *Kenya* | Cigarettes | 30 | 21 | 69% |
| *Denmark* | Malt | 30 | 20 | 67% |
| *South Africa* | Food prep | 28 | 18 | 66% |
| *Tanzania* | Tobacco, raw | 27 | 26 | 98% |

Source: Author's own computations using data from FAOSTAT (2019)

Table 3.8 shows the top 5 agricultural export products. Tobacco is the most important export product followed by sugar cane, tea, dried leguminous vegetables and cotton.

***Table 3.8: Malawi's Top 5 Agricultural Export Products***

| *HS Code* | *Product* | *Total (2001-2017)* | *Total (2013-2017)* | *% of Totals* | *2013* | *2014* | *2015* | *2016* | *2017* |
|---|---|---|---|---|---|---|---|---|---|
| *2401* | Tobacco | 7,958,505 | 2,766,908 | 35% | 553,678 | 646,655 | 495,643 | 540,533 | 530,399 |
| *1701* | Sugar Cane | 1,318,180 | 444,085 | 34% | 110,462 | 118,623 | 98,190 | 82,067 | 34,743 |
| *0902* | Tea | 1,030,407 | 366,340 | 36% | 83,279 | 77,380 | 66,820 | 67,300 | 71,561 |
| *0713* | Dried leguminous vegs. | 355,899 | 181,349 | 51% | 28,599 | 41,063 | 58,582 | 34,851 | 18,254 |
| *5201* | Cotton | 288,447 | 77,101 | 27% | 20,139 | 21,809 | 21,376 | 10,178 | 3,599 |

Source: Author's own computation using data from ITC (2019)

The destination of Malawian agricultural exports are shown in Table 3.9. The EU as an aggregate dominates. South Africa, USA, Egypt and Zimbabwe are the other destinations for the export products, outside the EU, notably 3 African countries are the other major destinations for exports.

***Table 3.9: Malawi's Top 5 Export Countries (Destinations)***

| *Country* | *Total (2001-2017)* | *Total (2013-2017)* | *% of totals* | *2013* | *2014* | *2015* | *2016* | *2017* |
|---|---|---|---|---|---|---|---|---|
| *EU* | 5,274,070 | 1,939,033 | 37% | 369,106 | 487,383 | 334,982 | 362,428 | 385,134 |
| *South Africa* | 996,273 | 295,110 | 30% | 65,224 | 76,521 | 60,249 | 50,080 | 43,036 |
| *USA* | 740,983 | 242,992 | 33% | 67,453 | 51,771 | 36,536 | 55,771 | 31,461 |
| *Egypt* | 707,575 | 201,975 | 29% | 8,149 | 61,700 | 56,809 | 25,993 | 49,324 |
| *Zimbabwe* | 591,599 | 182,485 | 31% | 34,674 | 34,346 | 60,717 | 30,621 | 22,127 |

Source: Author's own computation using data from ITC (2019)

The table compiles the top 5 import products for Malawi, wheat is the most imported products followed by milk, malt, cereal and malt extracts.

***Table 3.10: Malawi's Top 5 Import Products***

| *HS CODE* | *Product* | *Total (2001-2017)* | *Total (2013-2017)* | *% of Totals* | *2013* | *2014* | *2015* | *2016* | *2017* |
|---|---|---|---|---|---|---|---|---|---|
| *1001* | Wheat | 75,579 | 38,578 | 51% | 4,037 | 2,166 | 938 | 4,109 | 27,328 |
| *0402* | Milk | 60,936 | 26,124 | 43% | 5,263 | 4,500 | 4,981 | 4,879 | 6,501 |
| *1107* | Malt | 41,699 | 11,672 | 28% | 5,009 | 2,608 | 3,167 | 888 | - |
| *1102* | Cereal | 19,195 | 2,991 | 16% | - | 2,990 | 1 | - | - |
| *1901* | Malt Extracts | 9,658 | 8,540 | 88% | 96 | 3,226 | 14 | 2,186 | 3,018 |

Source: Author's own computation using data from ITC (2019)

***Table 3.11: Malawi's Top 5 Agricultural Export Sources***

| *Exporters* | *Total (2001-2017)* | *Total (2013-2017)* | *% of Totals* | *2013* | *2014* | *2015* | *2016* | *2017* |
|---|---|---|---|---|---|---|---|---|
| *Zambia* | 872,712 | 459,438 | 53% | 100,503 | 68,979 | 82,513 | 147,529 | 59,914 |
| *South Africa* | 723,184 | 248,660 | 34% | 38,630 | 47,008 | 50,537 | 50,007 | 62,478 |
| *Mozambique* | 486,459 | 71,473 | 15% | 18,177 | 15,511 | 11,707 | 10,126 | 15,952 |
| *EU* | 284,104 | 114,585 | 40% | 24,216 | 19,489 | 11,404 | 14,457 | 45,019 |
| *USA* | 262,870 | 63,800 | 24% | 12,860 | 5,349 | 4,767 | 17,934 | 22,890 |

Source: Author's own computation using data from ITC (2019)

Table 3.11 shows the top 5 export sources for Malawi; these are Zambia, South Africa, Mozambique, EU and Tanzania. The greatest source for Malawian imports is Zambia.

### 3.7 Summary and Conclusion

The data presented in this chapter has given a representative picture of the position at which Malawi is faring in terms of trade and how globalisation has improved trade over the years. Emphasis has been given to Malawi's agricultural trade, because Malawi's economy and its main exports are from agriculture, therefore the trade data figures are important when discussing globalisation and its impacts thereof. The data also shows agricultural and food production in Malawi over time. This data is important in this study because it shows the relationship between agricultural production and globalization over time by providing a comparative platform for the different years and the changes that have taken place as Malawi became more globalized and exposed itself to trade.

The chapter presented a country profile for Malawi. Malawi is a landlocked country located in Southeast Africa and is predominantly an agricultural driven economy and depends on agriculture for food, employment and foreign exchange earnings. Malawi's main produced crop is maize and it is the country's staple. Malawi's economy has gone through so many changes over the years. Notably, there has been an increase in the total merchandize trade from 60% in 2010 to 104% in 2014. This increase is an indicator of increased openness.

The cost of doing business in Malawi is high, due to transportation problems and this challenge impinges the quality of foreign direct investments in Malawi. Malawi has very few foreign investments. Malawi is also part of many trade agreements and enjoys preferences under bilateral trade agreements with Mozambique, South Africa, Zambia, Zimbabwe and customs union with Botswana. In addition, it exports its products to United States of America, Egypt, South Africa and Zimbabwe which are Malawi's top export countries.

# CHAPTER 4: METHODOLOGY AND DATA

## 4.1 Introduction

This chapter presents a brief overview of the Autoregressive Distributed Lag (ARDL) model, its general specification, hypothesis and the specific models stipulating the variables included in the analysis. It also includes the advantages of the model and the reasons behind its use as a model of choice for this study. Besides, the chapter includes a description of the variables employed and data treatment in the fitting of the model and descriptive statistics.

## 4.2 Econometric Model

The study makes use of the Autoregressive Distributed Lag (ARDL) model to analyse the impact of globalisation on food supply and maize production. There are two model specifications for the study depending on the choice of dependent variable. One specification adopts food supply as the dependent variable while the other employs maize production as the dependent variable. However, in both cases, globalisation remains the main independent variable.

The ARDL model is a time series based technique that allows the dependent variable to be a function of both current and past (lagged) values of not only itself but also values of other variables included in the model (Greene, 2008).

The choice of this model tallies with the property that, since the study employs time series data, ARDL is better suited to capture both short run and long run coefficient estimates based on a single equation specification. In estimating a single equation, the model reduces estimation errors, which is necessary for unbiased, reliable estimates which meet diagnostic and stability conditions. In addition, the model produces reliable estimates even when the sample size is small and it remains consistent when the variables have different orders of integration. Other techniques such as Engle-Granger, Johansen's and single equation models such as Dynamic Ordinary Least Squares (DOS) and Vector Error Correction (VEC) Models are also used to estimate long run and cointegration relationships among variables, however, these techniques require that the variables should be of the order I(1) or I(0). Pesaran and Shin (1998) proposed that ARDL models can be used to estimate cointegration relationships with variables at different levels of integration either I(0) or I(1), without requiring to pre-specify the variables either at I(0) or I(1) integration levels. Furthermore, ARDL models have different numbers of lag terms without requiring symmetry lag lengths. ARDL models also provide long run estimates even when some endogenous variables behave as regressors. These properties make

the ARDL models superior to all other time series econometric techniques (Nkoro & Uko, 2016).

Being a study that uses time series data, there are chances of producing spurious regressions due to the presence of unit roots (unpredictable systematic pattern). One of the ways suggested in literature to deal with unit roots is to difference the data (Narayan, 2006). Though differencing the data helps remove the unit root by making the data stationary, it is problematic as it also removes long run information about the equilibrium relationship that may exist between food supply or maize production and globalisation. This makes ARDL the most suitable model as it incorporates both short run dynamics (non-differenced data points) with long run dynamics in its test of co-integration. This produces consistent and reliable estimates, which give a coherent understanding of the underlying relationships (Nkoro & Uko, 2016).

Furthermore, the ARDL model is able to trace relationships among the variables in the short run and over time thereby being an attractive model in testing the possibility of co-integrating relationships among the variables (Pesaran, Shin, & Smith, 2001).

The model also proves to be an appropriate model for this study as it allows the researcher to investigate the impact of past year levels of food supply and maize production apart from providing estimates of the impact of globalisation on these variables. It is also vital because it conducts uncomplicated linear variable transformation to estimate a short-term and long-term variable in an unregulated error correction model. Due to its specification with lags and in a single equation, the model deals with biases arising from omitted variables, autocorrelation and endogeneity, when they exist in the system (Harris & Sollis, 2003). The study makes use of bounds test to check for the presence of linear long run relationship between the variables (Pesaran et al., 2001). The long run relationship (co-integration) is determined using the ARDL model in its error correction form.

Using the bounds test, the study tested the hypothesis of no co-integration relationship with the following as the null and alternative hypotheses respectively:

$$H_0: \varphi_1 = \varphi_2 = \varphi_3 = \varphi_4 = \varphi_5 = \varphi_6 = \varphi_7 = \varphi_8 = \varphi_9 = \varphi_{10} = 0 \quad (1)$$

$$H_a: \varphi_1 \neq \varphi_2 \neq \varphi_3 \neq \varphi_4 \neq \varphi_5 \neq \varphi_6 \neq \varphi_7 \neq \varphi_8 \neq \varphi_9 \neq \varphi_{10} \neq 0 \quad (2)$$

The definition and reference of symbols is given under model specification.

Pesaran et al. (2001) define the upper bound and lower bound critical limits where the upper bound limit assumes variables of zero order of integration while the lower bound limit assumes variables of first order of integration. Rejecting the null hypothesis of no co-integration requires the computed F-statistics to lie above the upper bound limit or below the lower limit; otherwise, the test fails to reject it. The study uses the Akaike Information Criteria (AIC) as the technique for determining the optimum lag period of the specified ARDL model.

### 4.3 Model Specification

The general model is specified as follows (Pinn et al., 2011);

$$\Delta y_t = \propto_0 + \alpha_1 y_{t-1} \beta_1 x_{t-1} + \sum_{i=1}^{p} \delta_i \Delta\, y_{t-i} + \sum_{j=0}^{q-1} \theta_j\, \Delta x_{t-j} + \mu_t \quad (3)$$

Where $y_t$ represents the dependent variable while $x_t$ represents the independent variables. The study adapted this model to form the following equations which define the relationship between dependent and independent variables:

*MaizeProd = f (Glob, Drought, Land, FISP, GDP, SP, SIP, CPI, PopGrowth)* (4)

*FoodSupply=f (Glob, Drought, Land, FISP, GDP, SP, SIP, CPI, PopGrowth)* (5)

These equations define the relationship between food security (using maize production and food supply as proxies) and the factors that affect it including globalisation. To investigate the impact of globalisation on food availability and access, the study makes use of two dependent variables to specify two different models. Model 1 represents the impact of globalisation on maize production while model 2 captures the impact of globalisation on food supply.

The following is the ARDL specification of the two models:

**Model 1**

$$\Delta MaizeProd_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1\, \Delta MaizeProd_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta Glob_{t-i} + \sum_{i=0}^{p} \varphi_3\, \Delta PopGrowth_{t-i} + \sum_{i=0}^{p} \varphi_4\, \Delta FISP_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta Drought_{t-i} + \sum_{i=0}^{p} \varphi_6\, \Delta Land_{t-i} + \sum_{i=0}^{p} \varphi_7\, \Delta SP_{t-i} + \sum_{i=0}^{p} \varphi_8\, \Delta SIP_{t-i} + \sum_{i=0}^{p} \varphi_9\, \Delta GDP_{t-i} + \sum_{i=0}^{p} \varphi_{10}\, \Delta CPI_{t-i} + \beta_1 MaizeProd_{t-1} + \beta_2 Glob_{t-2} + \beta_3 PopGrowth_{t-1} + \beta_4 FISP_{t-1} + \beta_5 Drought_{t-1} + \beta_6 Land_{t-1} + \beta_7 SP_{t-1} + \beta_8 SIP_{t-1} + \beta_9 GDP_{t-1} + \beta_{10} CPI_{t-1} + u_t \quad (6)$$

**Model 2**

$$\Delta lnFoodsupply_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1\, lnFoodsupply + \sum_{i=0}^{p} \varphi_2 \Delta Glob_{t-i} + \sum_{i=0}^{p} \varphi_3\, \Delta PopGrowth_{t-i} + \sum_{i=0}^{p} \varphi_4\, \Delta FISP_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta Drought_{t-i} + \sum_{i=0}^{p} \varphi_6\, \Delta Land_{t-i} + \sum_{i=0}^{p} \varphi_7\, \Delta SP_{t-i} + \sum_{i=0}^{p} \varphi_8\, \Delta SIP_{t-i} + \sum_{i=0}^{p} \varphi_9\, \Delta GDP_{t-i} + \sum_{i=0}^{p} \varphi_{10}\, \Delta CPI_{t-i} + \sum_{i=0}^{p} \varphi_{11}\, \Delta BreakDummy_{t-i} + \beta_1 lnFoodsupply_{t-1} + \beta_2 Glob_{t-2} + \beta_3 PopGrowth_{t-1} + \beta_4 FISP_{t-1} + \beta_5 Drought_{t-1} + \beta_6 Land_{t-1} + \beta_7 SP_{t-1} + \beta_8 SIP_{t-1} + \beta_9 GDP_{t-1} + \beta_{10} CPI_{t-1} + \beta_{11} BreakDummy_{t-1} + u_t \quad (7)$$

Where:

MaizeProd = Maize Production (tonnes)

Glob = Globalisation Index

PopGrowth = Population Growth (%)

FISP = Farm Input Subsidy Programme

Drought = Dummy for drought

Land = Agricultural land

SP = Dummy for Starter Pack

SIP = Dummy for Supplementary Input Programme

GDP = GDP/CAPITA

CPI = Consumer price Index

lnFood supply = Food supply (kcal/capita/day)

Break Dummy = Structural Break Dummy

$\varphi_0$ = Constant term

$u_t$ = White noise

$\varphi_1 - \varphi_{10}$ = Short run elasticities, coefficients of the first difference variables

$\beta_1 - \beta_{10}$ = Long run elasticies which are coefficients of the explanatory variables

$\delta$ = Speed of adjustment

$\Delta$ = First difference operator

$p$ = Lag length

Time series data often exhibits increased fluctuations over time which increase the likelihood of heteroscedasticity and general variance instability. The study makes use of logarithmic transformation and presents some of the variables in log form as the first step to counter such occurrences. Using logs instead of levels helps in dampening the increased fluctuations in the data and moves the data closer to stationarity (Maddala, 2001). Logs straighten out the data trends and makes it plausible to fit a linear model. It also becomes vital in results interpretation since it evaluates relative changes in variables, which is more important than changes that occur in levels. For example, it is easier and meaningful to interpret percentage change in food supply than it is to gauge the change in kilo calories per capita per day. Since the data for maize production is smoother and easier to interpret than the data for food supply which shows increased fluctuations, the study applies logs to food supply and treats maize production in levels as it does not affect the underlying relationships with the explanatory variables.

To investigate the presence of co-integration among the variables, the study estimates the following conditional ARDL models:

**Model 1**

$$MaizeProd_t = \varphi_0 + \beta_1 MaizeProd_{t-1}\ \beta_2 Glob_{t-1} + \beta_3 PopGrowth_{t-1} + \beta_4 FISP_{t-1} + \beta_5 Drought_{t-1} + \beta_6 Land_{t-1} + \beta_7 SP_{t-1} + \beta_8 SIP_{t-1} + \beta_9 GDP_{t-1} + \beta_{10} CPI_{t-1} + u_t \quad (8)$$

**Model 2**

$$lnFoodsupply_t = \varphi_0 + \beta_1 lnFoodsupply_{t-1} + \beta_2 Glob_{t-1} + \beta_3 PopGrowth_{t-1} + \beta_4 FISP_{t-1} + \beta_5 Drought_{t-1} + \beta_6 Land_{t-1} + \beta_7 SP_{t-1} + \beta_8 SIP_{t-1} + \beta_9 GDP_{t-1} + \beta_{10} CPI_{t-1} + \beta_{11} BreakDummy_{t-1} + u_t \quad (9)$$

To investigate the short run dynamic relationship, the study employs the following specification of the error correction models;

**Model 1**

$$\Delta MaizeProd_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1\, \Delta MaizeProd_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta Glob_{t-i} + \sum_{i=0}^{p} \varphi_3\, \Delta PopGrowth_{t-i} + \sum_{i=0}^{p} \varphi_4\, \Delta FISP_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta Drought_{t-i} +$$

$$\sum_{i=0}^{p} \varphi_6 \, \Delta Land_{t-i} + \sum_{i=0}^{p} \varphi_7 \, \Delta SP_{t-i} + \sum_{i=0}^{p} \varphi_8 \, \Delta SIP_{t-i} + \sum_{i=0}^{p} \varphi_9 \, \Delta GDP_{t-i} + \sum_{i=0}^{p} \varphi_{10} \, \Delta CPI_{t-i} + \delta ecm_{t-1} + u_t \quad (10)$$

**Model 2**

$$\Delta lnFoodsupply_t = \varphi_0 + \sum_{i=1}^{p} \varphi_1 \, lnFoodsupply_{t-i} + \sum_{i=0}^{p} \varphi_2 \Delta Glob._{t-i} + \sum_{i=0}^{p} \varphi_3 \, \Delta Pop.Growth_{t-i} + \sum_{i=0}^{p} \varphi_4 \, \Delta FISP_{t-i} + \sum_{i=0}^{p} \varphi_5 \Delta Drought_{t-i} + \sum_{i=0}^{p} \varphi_6 \, \Delta Land_{t-i} + \sum_{i=0}^{p} \varphi_7 \, \Delta SP_{t-i} + \sum_{i=0}^{p} \varphi_8 \, \Delta SIP_{t-i} + \sum_{i=0}^{p} \varphi_9 \, \Delta GD_{t-i} + \sum_{i=0}^{p} \varphi_{10} \, \Delta CPI_{t-i} + \sum_{i=0}^{p} \varphi_{11} \, \Delta BreakDummy_{t-i} + \delta ecm_{t-1} + u_t \quad (11)$$

Where:

$ecm_{t-1}$ = Error correction term lagged for one period

Data analysis for the study was conducted using Eviews 10 statistical software.

## 4.4 Variable Description

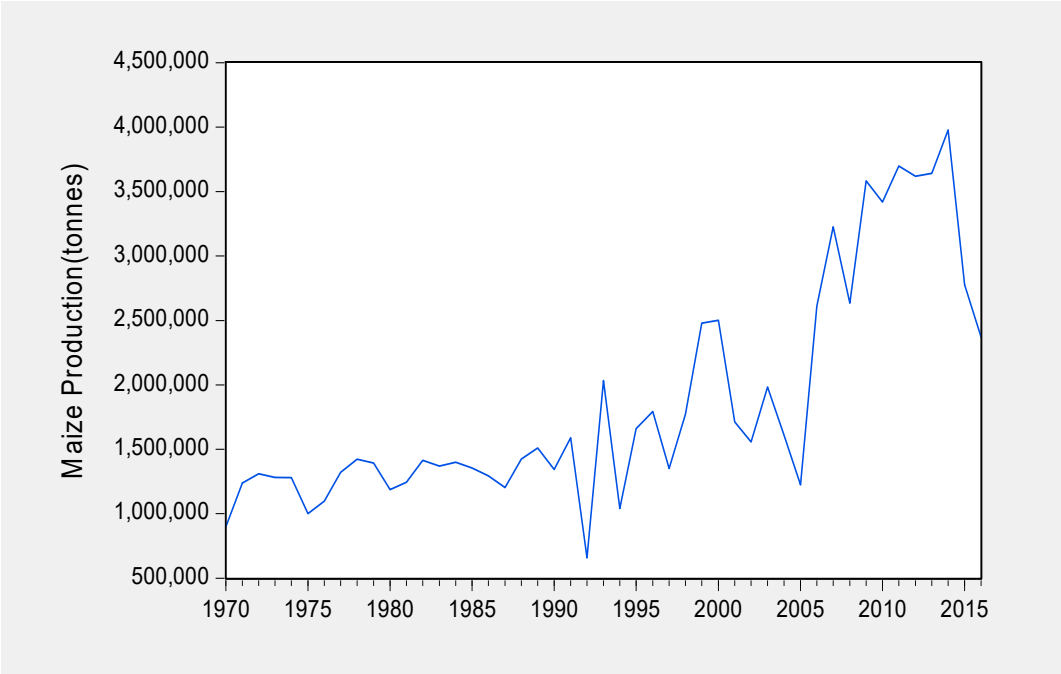
### 4.4.1 Maize Production

This is one of the dependent variables in the study. Maize is Malawi's main staple food and maize production is regarded as a proxy for food security. Malawi is a landlocked country with high reliance on its own domestic food production. Domestic production is the main source of food supply that meets the consumption needs for the population. In case of deficits, Malawi spends three times more than the costs for producing food in Malawi on foreign exchange to import maize from the world market (Devereux, 1997). Since 1964, the year that Malawi became independent, the Government of Malawi has equated food sufficiency and security with maize production. For many years, Malawi has been considered self-sufficient except for a few drought years. The crop is also the focus of many programmes of food security, policies and interventions. In these programmes, farmers are encouraged to adopt hybrid technologies, new farming technologies and the use of chemical fertilizers in order to improve the productivity of maize and also to meet the self-sufficiency goals (Devereux, 1997).

Besides, Mazunda and Droppelmann (2012) define food security as the availability and access of maize and argue that maize consumption is also sometimes used as an indicator of food security. In this study, maize production is used to measure food security from the year 1970 to 2016. Maize production is measured in tonnes produced annually. Eighty percent of Malawi's population consumes maize as their main staple food. Maize corn consumption per

capita is 133 kg per year and represents over 54% of household caloric intake and 90% of total cereal intake in Malawi (FAO, 2014).

***Figure 4.1: Maize Production (Tonnes) in Malawi (1970-2016)***



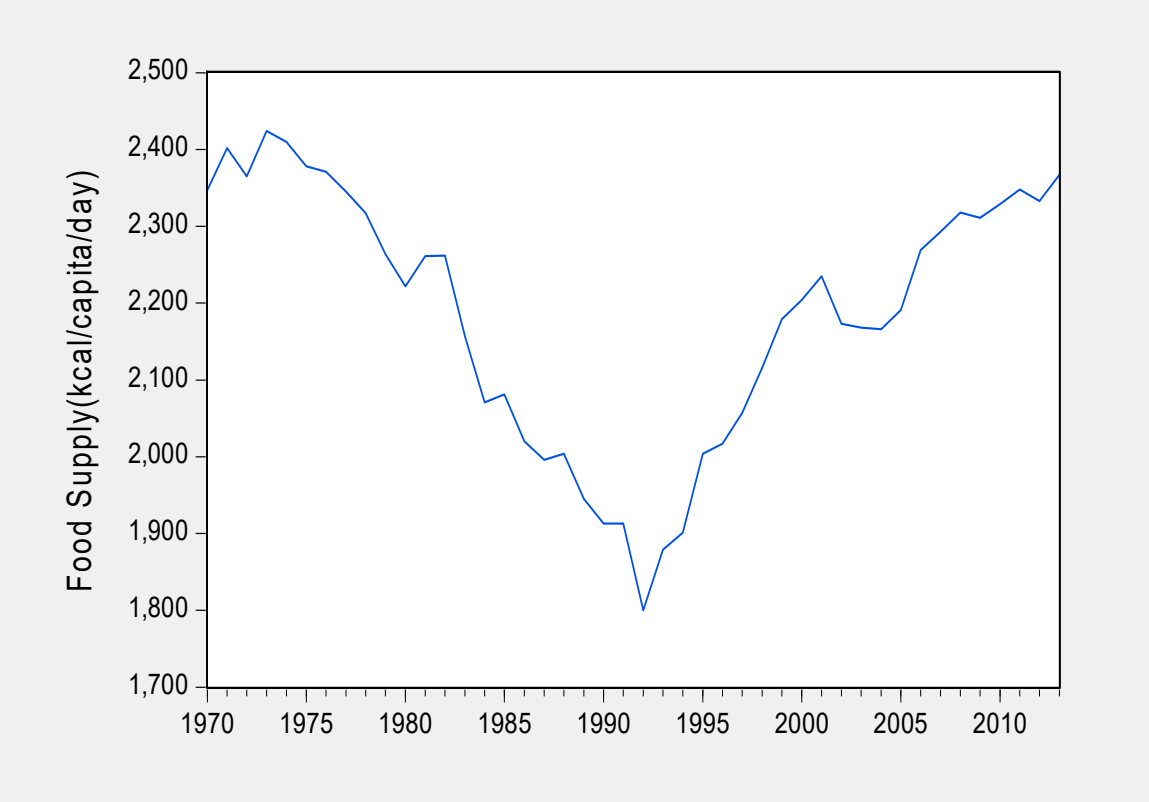

Sources: Author's own graph using data from FAOSTAT (2019)

The figure shows the maize production trends in tonnes from 1970 to 2016. Notably, the trend conveys an increase in the maize production with some variations and a sharp decline in the year 1994, 2005, 2015 and others.

### 4.4.2 The Log of Food Supply

Food supply is a food security indicator which corresponds to the dimension of stability as disseminated in FAOSTAT (FAOSTAT, 2019). Food supply is expressed in Kilocalories per capita per day. The indicator estimates food supplies available for consumption per capita during a given period, given to the measurements of the quantity, the value of calories and protein and fat content. The caloric supplies are measured in Kilocalories where 1 calorie is equal to 4.19 Kilojoules (Napoli et al., 2011).

***Figure 4.2: Food Supply (Kcal/Capita/Day) in Malawi (1970 – 2013)***




Sources: Author's own graph using data from FAOSTAT (2019)

Food supply is one of the dependent variables in the study and it indicates food availability and access, which represent food security. This variable was selected among the many other indicators because of availability of data and also its ability to represent the food availability component of food security. The figure gives a picture of the type of data and the trends of annual food supply from 1970 to 2013.

A sharp decline is noted in the year 1992. Between 1991-1993 foreign aid to Malawi was reduced sharply because donors tied it to political reform. Aid resumed in 1993 after President Hastings Banda permitted free elections. So the decline took place because of reasons such as the political reform, besides that Malawi in the year 1992 faced a serious drought which reduced food supply, leading to the decline of the trend.

The trend shows a u-shape over the period displaying a continued decline in food supply until 1993, where it started to go up, the reason for this shape is a structural break that took place due to a change in the leadership of Malawi. In the model, a break in the data has been introduced, to control for problems that are caused by structural breaks. The data in the model

runs from 1987 to 2013. The overview of the data with a structural break is presented in the summary of statistics section and the dummy variable is separately described in section 4.5.10.

### 4.5 Independent Variables

The study's main purpose is to investigate the effect of globalisation on food availability and access by examining the effects of globalisation on maize production and food supply. The independent variables for these objectives are globalisation, Farm Input Subsidy Programme, drought, Starter Pack, Supplementary Input Programme, agricultural land, population growth and per capita GDP growth. These independent variables are discussed in detail below.

#### 4.5.1 Globalisation Index

Globalisation is measured using the KOF globalisation indicator which was developed by Konjunkturforschungsstelle (German word for Economic Research Institute) and was introduced by Dreher (2003), in 2002 at the Swiss Economic Institute. Dreher et al. (2008) updated the index which was also later updated by Gygli et al. (2018). The KOF globalisation index combines different variables and different aspects of globalisation into one global index by aggregating all the different components and characteristics of globalisation. The index measures the small components of globalisation such as the political, economic and social sub-components of globalisation starting from 1970 for almost all of the World's countries.

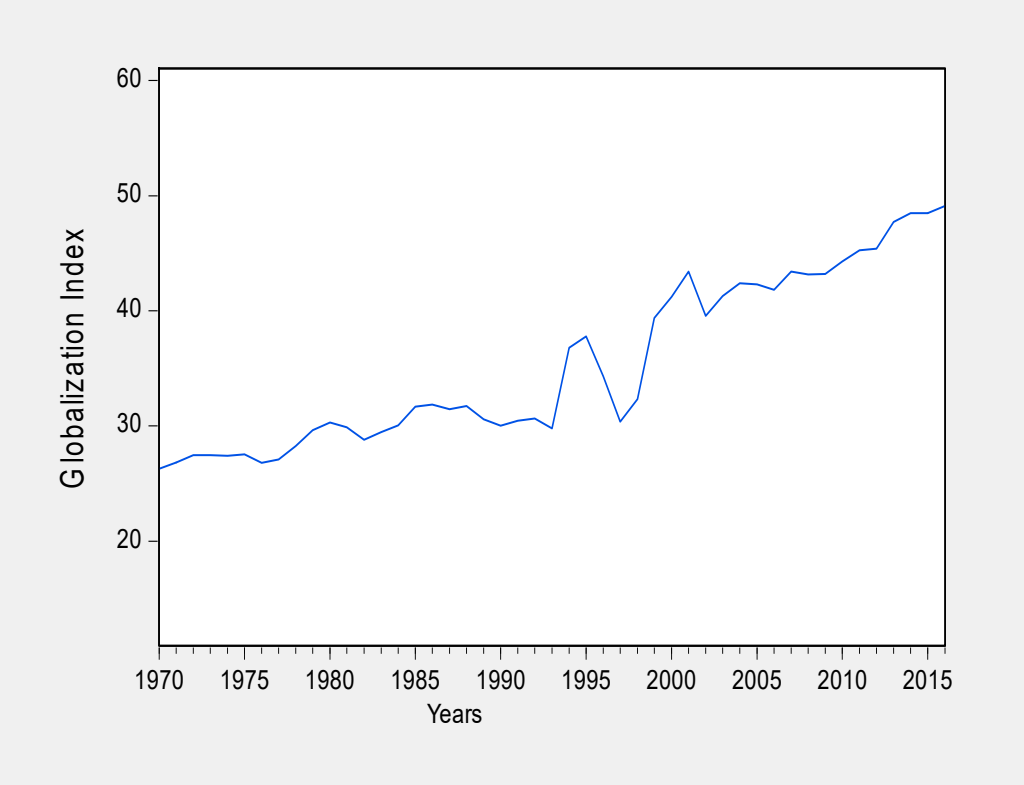
There are many other indices that have been developed to measure globalisation. Some of the popular ones include: the Kearney or Foreign Policy Magazine Index, CSGR Index, Global index and Maastricht Globalisation Index. However, KOF is the most used index among all the other indices. The KOF index is updated annually and considered to be the best metric of globalisation, because it measures trade rates, foreign capital and policy constraints and is intended to quantify the political and social dimensions of globalisation as opposed to other indices (Samimi et al., 2011). The other advantage of the index is that it has records for many years and for almost all the countries of the world including the Malawi, the study's country of interest.

Every year, the overall globalisation figure is presented and also the measurement for the subcomponents of globalisation. The largest component of the indices is social globalisation, because it comprises of many technology related variables.

The calculation of the KOF Globalisation Index involves dividing all the components that form the index by the GDP of the country. In other cases, instead of GDP, population size is used.

The index is available for about 200 countries in a panel data setting (Gygli et al., 2018). The variables included in the Index range between 1 and 100 (with 1 as the smallest and 100 as the highest) after being converted to ensure comparability. The higher the index values, the more a country is considered globalized. The data for the index includes globalisation values for the period 1970-2017 (KOF, 2017). The figure shows the trend of globalisation in Malawi from 1970 to 2016. The data is sourced from the KOF Swiss Economic Institute.

***Figure 4.3: Globalisation Index for Malawi (1970-2016)***




Source: Author's own graph using data from KOF Swiss Economic Institute, 2019

Economic globalisation comprises goods, capital and services flow measured using trade flows, foreign direct investments and portfolio investments. These variables are expressed as ratios of GDP. In addition, it also measures trade and capital restrictions using import barriers and tariff rates on international trade (Dreher, 2006). Political globalisation is about the dispersal of governmental policies while social globalisation focuses on flow of information, ideas and people across countries (Nye & Keohane, 2000). The KOF globalisation Index combines all these different variables and the different aspects of globalisation into one overall index.

There are so many changes that have taken place over the years in the food and agricultural sector due to technological changes. These technologies are associated with globalisation and have been in the form of production technologies, packaging, storing and transportation. These technologies have made it easy for farmers to access food and even have had an impact on the level of productivity thereby making the KOF globalisation index useful in measuring the significance of its effort to contribute to food security (Narayanan & Gulati, 2002).

The expected sign for globalisation on maize production is a positive sign, because of the technologies that are introduced by globalisation. Similarly, the expected sign for globalisation on the food supply results is also positive because of the increase in production that is influenced by biotechnology, improved technologies and also the reduction of food prices that is caused by the ease in importing food by virtue that globalisation reduces cross-border prices.

### 4.5.2 Farm Input Subsidy Programme (FISP) (Dummy)

This is a dummy variable for fertilizer subsidy, which has been included in the two models. It is expected that fertilizer subsidies increase the farmers capacity to increase maize output. As such, the two models are expected to have a positive coefficient. The programme started in 2004 till present and the years that the FISP has been running are coded as 1 and 0 for those years without the programme.

### 4.5.3 Drought (Dummy)

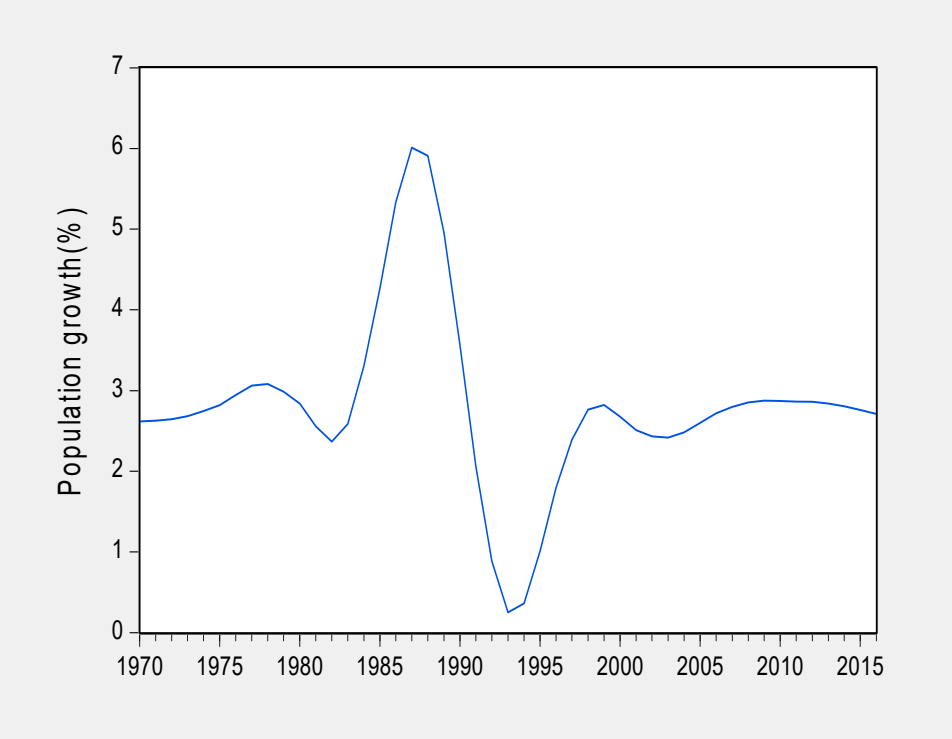
Drought is one of the regressors which is related to maize production and food supply. Food in Malawi is usually sourced from non-irrigated land as such drought influences the production of food. Malawi is one of the countries that has had a number of drought incidences such as in the years 1979, 1981, 1992, 1994, 2002, 2004, 2005, 2015 and 2017. This variable is presented as a dummy variable in the estimation of the model, whereby the years that had a drought occurrence are represented by 1 and 0 for the years that did not have a drought occurrence. Inadequate rainfall reduces yield, therefore for every drought occurrence there is reduction in the maize output. As such, a negative coefficient is expected for the coefficient in both models.

### 4.5.4 Population Growth (%)

Percentage change in population infers changing consumption pattern, raising incomes, higher consumption, therefore higher demand for food. Population growth also affects the landholding sizes of the population. The more the population grows, the more the share of land sizes decreases per capita (Narayanan & Gulati, 2002). Assuming that farmers experience minimal changes in production per land area, a reduction in land size would imply decreased output per

capita. A reduction in land size has an impact on food production, because land is a main factor of production. A negative sign is expected on the coefficient of population growth because population growth has an impact on land sizes and distribution of fertile land.

***Figure 4.4: Population Growth Trends for Malawi (1970-2016)***




Source: Author's own graph using data from World Bank Development Indicators (2019)

### 4.5.5 Starter Pack (SP) (Dummy)

The starter pack was introduced because of the declining soil fertility in Malawi. This was after a technical examination by the Maize Productivity Task Force, which was established in 1996. The starter pack was introduced as a recommendation to deal with food shortages and it was implemented from 1998-2003. The food shortages were due to reduced fertility and maize productivity and the only solution to reduce the impact on productivity was the use of inorganic fertilizer. The use of the starter pack package was a solution to remedy the problem which was birthed after five years of field trials and research (Harrigan, 2008).

The starter pack consisted of 2kg packs of semi-flint hybrid maize and a 15kg bag of fertilizer. It improved the maize output and the yield also rose significantly. According to Harrigan (2008), even though the starter pack was meant to achieve food sufficiency, it also posed as a potential food security booster through its ability to enable smallholder farmers to produce extra 100-150 kilograms of maize per household. Secondly, the starter pack also impacted the

maize consumer price through the provision of extra maize to households. Additionally, it also affected the maize demand on the market by reducing it, and the poor families were not outshined by the rich that sold maize at higher prices because the prices were reduced (Harrigan, 2008). The starter pack is believed to have helped attain the 3 dimensions of food security of accessibility, availability and utilization through the output and price effect and utilization through the inclusion of legumes in the pack (Harrigan, 2008). The sign for starter pack is expected to be positive because of its ability to harness input access to most smallholder farmers that barely afforded inputs for production.

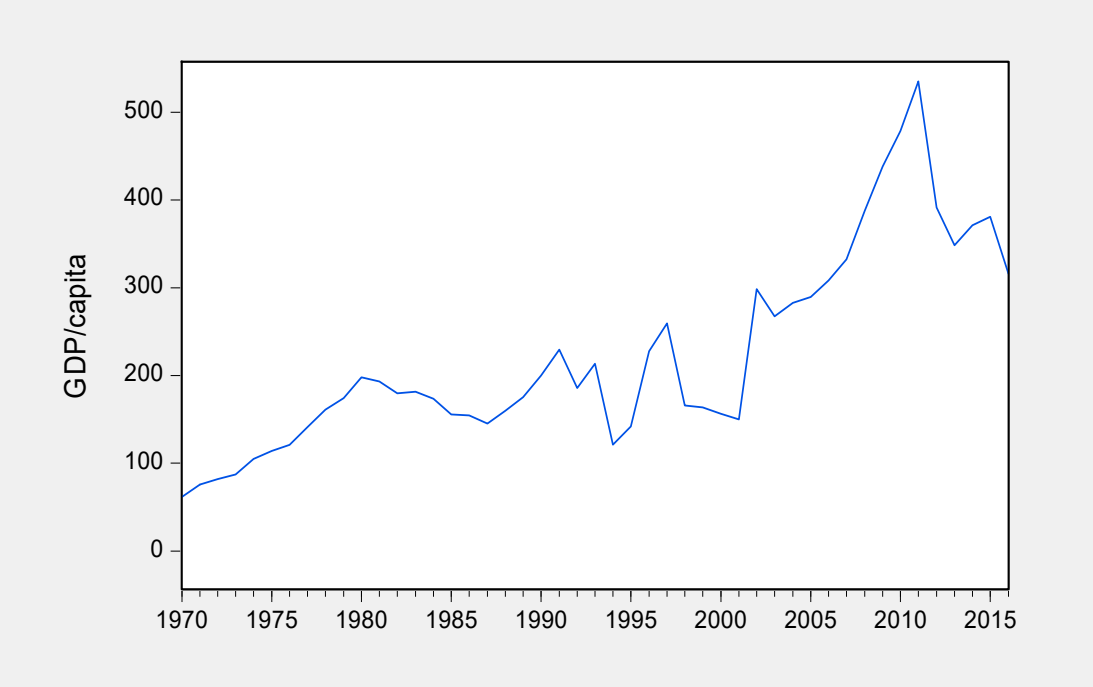
### 4.5.6 Supplementary Input Programme (SIP) (Dummy)

The Supplementary Input Program was a project of the Government of Malawi with support from ODA (now DFDI), which distributed free maize seed to farmers in all regions of Malawi. The main objective of the project was to increase access to hybrid maize seeds and fertilizers in order to improve maize yields. The project also helped most farmers that could not afford purchasing hybrid seeds and fertilizer due to rising prices. This input distribution programme was implemented in the years 1994 to 1996. The Supplementary Input Program is expected to have a positive sign due to its ability to help farmers to access farm inputs and also to increase yields (Harrigan, 2008).

### 4.5.7 Gross Domestic Product Per Capita (GDP)

In this model, GDP per capita is used as an indicator of economic development which helps reduce hunger, malnutrition and poverty. This is because economic development comes with increases in employment and income. When income increases in households through employment and wages, household members are able to afford purchasing food. Economic development ensures that there is an increase in the number of opportunities and a growing labour force (FAO, IFAD & WFP, 2015). Notably, when the income of the people increases, the food consumption levels also improve, the dietary requirements and the intake of vital nutrients also increases, therefore a positive sign is expected for GDP.

*Figure 4.5: GDP Per Capita Trends for Malawi (1970-2016)*




Source: Author's own graph using data from World Bank Database (2019)

### 4.5.8 Consumer Price Index (CPI)

The CPI measures changes in the level of prices for buying goods and services. This indicator gives a picture of the demand side because it reflects prices at which the commodities are bought by consumers. The indicator can also reveal how accessible food is for the isolated population. This is possible when the indicator is combined with an economic indicator like GDP per capita (Napoli et al., 2011).

Marketing issues are very crucial in food security analysis because they connect the food consumers and producers. Marketing forms an important linkage in the food systems. With the increase in migration and specialization in the rural sector it is expected that effective marketing systems are created and become the most important factor in ensuring food security.

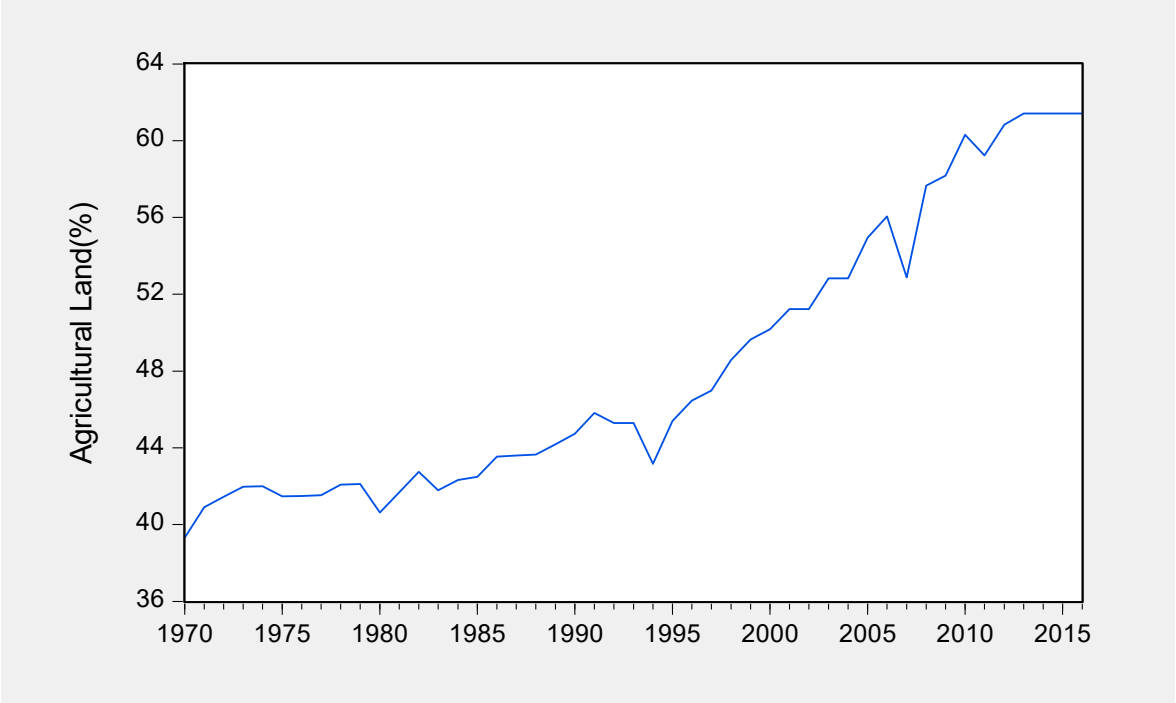
The main problem in marketing are the food prices which are believed to be so high. According to Timmer et al. (1983), food prices are too high while the prices for crops are so low. This statement is known as the 'food price dilemma'. For poor consumers that mainly spend so much on starchy foods, their consumption levels are determined by the prices of those particular foods. While for producers, crop prices determine their level of incomes and also the decisions of which crops to produce. The incentives provided by crop prices determine the adequacy of the food supplied. The inverse impact that food and crop prices have on consumers

and producers triggers attention from policy makers, on determining the levels of margins and costs. However, due to lack of consistent data on prices, the model does not include variables to capture prices except for the consumer price index which gives a general measure of price changes.

### 4.5.9 Agricultural Land (Land)

Agricultural land is measured as a percentage of land allocated to agricultural activities against the total available land. It is expected that a large land size implies a high output. As such the variable for land size is expected to have a positive sign.

***Figure 4.6: Land Allocated to Agricultural Activities (% of Total Land) for Malawi (1970 – 2016)***




Source: Author's own graph using data from World Bank Database (2019)

### 4.5.10 Structural Break Dummy

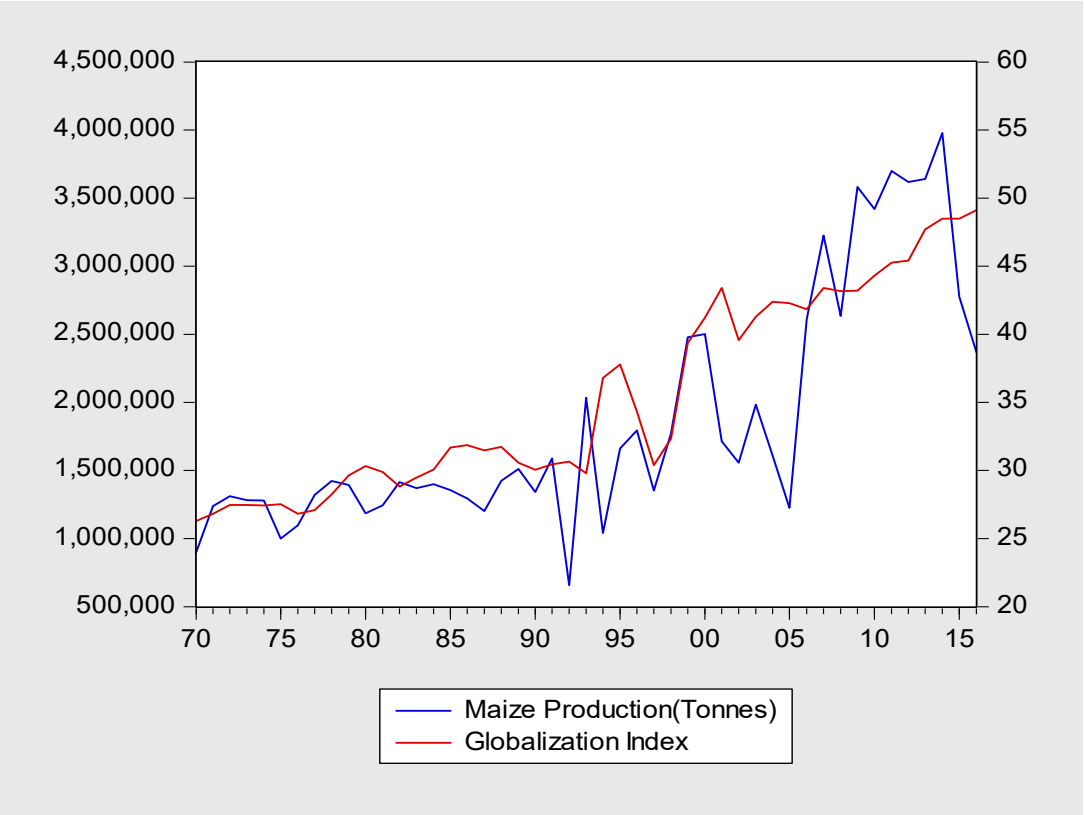
The data series for food supply (dependent variable for model 2) runs from a period of 1970 to 2013. However, the trend for the data has a unique U shape, caused by a structural break in the year 1993. The structural break which is evident in Figure 4.2 was as a result of the change in government from a one-party system to a multiparty system. In order to account for the changes in the trend before and after the period, a dummy is introduced to correct for the difference in the trend. From 1987 to 1993, it is regarded as a period that did not have any structural changes

and assumed a 0, while from the period 1993 to 2013 assumed otherwise and was denoted by 1.

## 4.6 The Analysis of Globalisation and Food Security Trends

### 4.6.1 Analysing Globalisation and Maize Production Trends in Malawi

***Figure 4.7: Maize Production and Globalisation Trends in Malawi***




Sources: Authors own graph using data from FAOSTAT (2019) and KOF Swiss Economic Institute (2019)

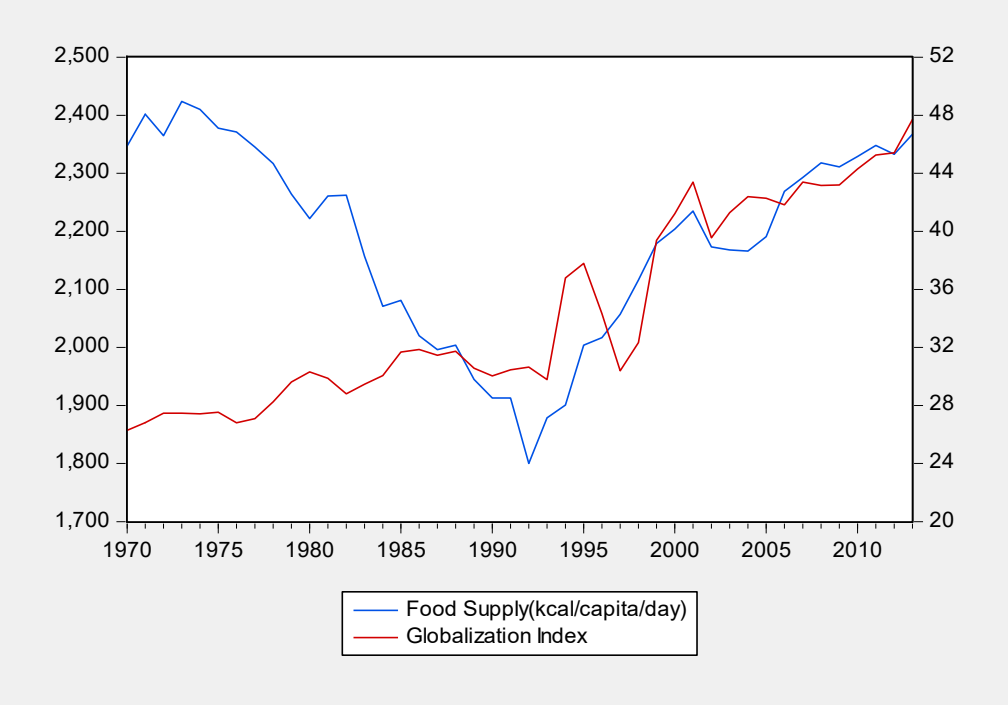
In this section the data is drawn from the FAOSTAT database and the KOF Swiss Economic Institute. This analysis comprises of data ranging from 1970 to 2016 and shows the globalisation and maize production trends in Malawi. Globalisation is measured using an index while maize production in this figure is in tonnes. Maize is the most important crop in Malawi. The maize production trend is a reflection of the nature of the primarily Malawian agriculture sector, in a way that Maize is Malawi's staple food, and accounts for a significant proportion of agricultural production. The trend for maize production has been fluctuating. The more Malawi achieved higher levels of globalization, the more production increased. The fluctuation is a characteristic that other factors such as drought also affected the maize production. For

instance, in the year 1976, the country experienced a drought hence the notable decline in the trend. Similarly, there is a sharp decline in maize production in the years 1992, 1994, 2002, 2004, 2005, 2015 and 2017 because of the drought occurrence.

This shows that despite the progress that arises due to the benefits of globalisation, the food and agricultural sector in Malawi especially maize production is greatly affected because farming in Malawi is dependent on good and sufficient rain. The trend also depicts that the years that Malawi did not have any drought occurrence, the more the globalisation trend showed an upward increasing trend, the more maize production also increased.

### 4.6.2 Globalisation and Food Supply Trends in Malawi

***Figure 4.8: Trends for Globalisation and Food Supply in Malawi (1970 – 2013)***




Sources: Author's own graph using data from FAOSTAT (2019) and KOF Swiss Economic Institute (2019).

The graph illustrates the trends for globalisation and food supply in Malawi from 1970 to 2013. Food supply presents the amount of food supplied in kilocalories in per capita terms annually. Notably, there has not been a significant change in the amount of food supplied from 1970 to 2013. A significant decline is noted in the years 1990 to 1994, which were years that Malawi was seriously struck with a drought. Another decline is noted between the years 2002 and 2005 which were also years of drought in Malawi. Globalisation levels have continuously steeped up with some notable declines in 1993, 1997, 2002, 2006 and 2012.

Between 1991-1993, foreign aid to Malawi was reduced sharply because donors tied it to political reform. Aid resumed in 1993 after President Hastings Kamuzu Banda permitted free elections to take place in 1993. However, donor aid was not only withdrew during Banda's reign, it has been withdrawn in subsequent political periods such as the reigns of Bakili Muluzi, Bingu Mutharika and the Joyce Banda presidential term for different reasons such as poor governance, corruption and poor human rights (Malawi Aid Atlas, 2010).

There was an increase in aid inflows and donor support during the years 1991 to 1995 which were the years that Malawi transitioned to a democracy. However, aid was withdrawn in 1995 after the govermment lost its fiscal control in 1994. The budget had a deficit of 37% of the GDP which emerged to be the largest deficit that has ever been recorded. Besides that, inflation peaked at 80% in 1995. The new government responded quickly to the withdrawal of aid in 1995. They further reduced the budget deficit to 7.5% of GDP and inflation down to 8% by the years 1996 and 1997 respectively (World Bank, 2003a). In a post-election period, the political feasibility of governing public spending also contributed to the good policy of the new government.

Often contributing to a growing fiscal deficit was spending on public services prior to the 1999 elections. Nevertheless, donors did not stop assistance inflows this time. Two successive droughts struck the country in 2001 and 2002, and had huge impact largely due to Strategic Grain Reserve mismanagement (Devereux, 2002). In 2001 and 2002, the IMF withheld financial support, followed by bilateral donors. Nevertheless, withdrawing donor balance-of-payments assistance did not result in a reduction in total spending, but in further fiscal deterioration (World Bank, 2003).

In 2010 aid was withdrawn because of poor governance and the President's increasing autocracy and intolerance. Support was restored in 2012 when Joyce Banda took over after the sudden death of Bingu Wa Mutharika, the incumbent president at that time. Joyce Banda devalued the Malawian currency (the kwacha) by a third to meet the requirements of the International Monetary Fund to restore support. This caused a panic in the purchase of basic goods as prices rose highly in a short time. However, in 2013 during the Joyce Banda administration, the Common Approach to Budget Support (CABS) withheld Aid after losing confidence in how the country mismanaged public finances. Donors have withdrawn Aid due to allegations of corruption and looting of state resources by senior civil servants and politicians (Chikoko, 2014).

These scenarios explain the different response in the changes of the trend of globalisation. The changes also affected food supply because Malawi is heavily dependent on donor support to finance most of its projects, therefore a change in the nations resources affected different projects and caused inefficient patterns and composition of public expenditure in agriculture.

## 4.7 Summary Statistics

### 4.7.1 Summary Statistics for Model 1: Dependent Variable Maize Production

Before showing the econometric analysis, descriptive statistics are provided. Summary statistics indicate the type of data that has been used by providing an overview of the data values in a summarized form. Table 4.1 shows the summary statistics for the variables in model 1 and Table 4.2 shows the summary statistics in model 2.

***Table 4.1: Summary Statistics for Model 1 (1970 – 2016)***

| | **Maize Production** | **Globalisation Index** | **GDP per Capita** | **Agricultural land (%)** | **Population Growth** |
|---|---|---|---|---|---|
| Mean | 1.861925 | 35.38404 | 222.9497 | 48.21898 | 2.814975 |
| Median | 1.423848 | 31.73000 | 181.5376 | 45.29062 | 2.759462 |
| Maximum | 3.978123 | 49.11000 | 534.9513 | 61.41281 | 6.008499 |
| Minimum | 0.657000 | 26.29000 | 61.76554 | 39.31905 | 0.251161 |
| Std. Dev. | 0.871722 | 7.334025 | 111.4909 | 7.170758 | 1.105251 |
| Skewness | 1.087952 | 0.447206 | 0.906709 | 0.705352 | 0.733415 |
| Kurtosis | 2.962690 | 1.692290 | 3.142524 | 2.046286 | 5.463145 |
| Jarque-Bera | 9.274569 | 4.915571 | 6.479733 | 5.678492 | 16.09490 |
| Probability | 0.009684 | 0.085624 | 0.039169 | 0.058470 | 0.000320 |
| | | | | | |
| Sum | 87.51048 | 1663.050 | 10478.63 | 2266.292 | 132.3038 |
| Sum Sq. Dev. | 34.95535 | 2474.245 | 571790.4 | 2365.309 | 56.19267 |
| Observations | 47 | 47 | 47 | 47 | 47 |

### 4.7.2 Summary Statistics for Model 2: Dependent Variable Log of Food Supply

*Table 4.2: Summary Statistics for Model 2 (1970 – 2013)*

| | Log of Food Supply | Globalisation | GDP per Capita | Agricultural land (%) | Population Growth (%) |
|---|---|---|---|---|---|
| Mean | 7.686185 | 34.47682 | 213.8862 | 47.31940 | 2.818894 |
| Median | 7.702096 | 31.58000 | 177.4746 | 45.01485 | 2.752951 |
| Maximum | 7.793174 | 47.71000 | 534.9513 | 61.41281 | 6.008499 |
| Minimum | 7.495542 | 26.29000 | 61.76554 | 39.31905 | 0.251161 |
| Std. Dev. | 0.079529 | 6.658829 | 109.1944 | 6.483379 | 1.143004 |
| Skewness | -0.610345 | 0.491788 | 1.141510 | 0.850720 | 0.699520 |
| Kurtosis | 2.284625 | 1.683121 | 3.803258 | 2.415258 | 5.107374 |
| | | | | | |
| Jarque-Bera | 3.670053 | 4.952920 | 10.73858 | 5.934173 | 11.73028 |
| Probability | 0.159609 | 0.084040 | 0.004657 | 0.051453 | 0.002837 |
| Sum | 338.1922 | 1516.980 | 9410.991 | 2082.053 | 124.0313 |
| Sum Sq. Dev. | 0.271970 | 1906.620 | 512707.4 | 1807.471 | 56.17773 |
| Observations | 44 | 44 | 44 | 44 | 44 |

Table 4.3 shows the summary statistics of food supply after the structural break. The summary contains data that runs from 1987 to 2013, with 27 observations as shown in the table below:

*Table 4.3: Summary Statistics for Model 2 after Structural Break (1987 – 2013)*

| | Log of Food Supply | Globalisation | GDP per Capita | Agricultural land (%) | Population Growth (%) |
|---|---|---|---|---|---|
| Mean | 7.659357 | 38.15259 | 261.2208 | 50.83479 | 2.687579 |
| Median | 7.681560 | 39.56000 | 229.5275 | 50.16971 | 2.716978 |
| Maximum | 7.769379 | 47.71000 | 534.9513 | 61.41281 | 6.008499 |
| Minimum | 7.495542 | 29.79000 | 121.2641 | 43.16928 | 0.251161 |
| Std. Dev. | 0.080765 | 5.930718 | 111.7675 | 5.981644 | 1.336271 |
| Skewness | -0.334961 | -0.200896 | 0.812580 | 0.378383 | 0.719727 |
| Kurtosis | 1.878397 | 1.509897 | 2.788166 | 1.805649 | 4.259958 |
| | | | | | |
| Jarque-Bera | 1.920138 | 2.679573 | 3.021769 | 2.249063 | 4.116965 |
| Probability | 0.382866 | 0.261902 | 0.220715 | 0.324805 | 0.127648 |
| | | | | | |
| Sum | 206.8026 | 1030.120 | 7052.963 | 1372.539 | 72.56463 |
| Sum Sq. Dev. | 0.169598 | 914.5089 | 324791.6 | 930.2817 | 46.42615 |
| Observations | 27 | 27 | 27 | 27 | 27 |

### 4.8 Summary and Conclusion

This chapter reviewed the Autoregressive Distributed Lag (ARDL) model, equations for the hypothesis, the model specifications for the cointegration relationships, and the short run relationship specification. The chapter also portrays the general model of the ARDL Model which shows the relationship between the variables. There are two model specifications for the study depending on the dependent variable. One specification adopts food supply as the dependent variable while the other employs maize production as the dependent variable which are proxies for food availability and access respectively. Equations which define the relationship between food availability and access (using maize production and food supply as proxies) have also been presented in this chapter. Furthermore, the chapter expounds on the

characteristics of the ARDL model and the reasons that makes it more attractive for analysis in this study compared to other econometric techniques.

The independent variables that have been included in the model specifications include: globalisation, Farm Input Subsidy Programme, drought, Starter Pack, Supplementary Input Programme, agricultural land, population growth and per capita GDP growth. These independent variables are discussed in detail in this chapter and descriptive statistics are presented including the trends of the different variables. The chapter also presents summary statistics for both models, to indicate the type of data that has been used in the analysis.

# CHAPTER 5: EMPIRICAL RESULTS AND INTERPRETATION

## 5.1 Introduction

This chapter presents the Autoregressive Distributed Lag (ARDLs) empirical estimation findings. It also reports the results of stationarity tests, co-integration tests, and various other diagnostic tests. The first set of results to be presented are the short run results for model 1, which show the impact of globalization on maize production followed by the results for the long run model. The second part constitutes the short run and long run results for model 2, which presents the impact of globalization on food supply in Malawi.

## 5.2 Unit Root Test for Model 1 (Impact of Globalization on Maize Production)

The first diagnostic test that the study conducts is the testing of whether the data is stationary or not. By using the Augmented Dickey-Fuller Test, the study checks for the constancy of mean, variance and covariance of the data. When the underlying data generating process shows high fluctuations, the test determines whether this indicates the presence of a unit root. The null hypothesis is that the data has unit root, which means that the mean, variance and covariance of the data is not constant over time. Rejecting the presence of a unit root implies the stationarity of the data. Otherwise, the data demands the use of differencing methodology or co-integrating techniques if the study is to produce meaningful results.

A significant p-value for the test would suggest rejecting the availability of a unit root, whereby the variable would be deemed stationary. When a series is non-stationary, researchers can study its attributes only for a specific period as it gives divergent statistical attributes over time. This hinders generation of forecasts due to impossibility of generalizing results to other periods (Gujarati, 2005).

Table 5.1 gives the Augmented Dickey-Fuller test results for model 1 with all variables showing a unit root except for per capita Gross Domestic Product. However, the data became stationary after differencing the variables at order one, i.e. I(1). This aligns with ARDL model requirements where variables have to be integrated of order zero or one, with none of the variables in the model being I(2). The second column in Table 5.1 shows level variable p-values and the third column gives stationary p-values of the variables after first differencing.

*Table 5.1: The Augmented Dickey Fuller Test results for Model 1*

| Variable | ADF in levels (P-value) | ADF in First Difference (P value) | Integration Order |
|---|---|---|---|
| **Globalization** | 0.9937 | 0.0000 | 1 |
| **Agricultural Land** | 0.9968 | 0.0000 | 1 |
| **Maize Production** | 0.2204 | 0.0000 | 1 |
| **Population Growth** | 0.3590 | 0.0011 | 1 |
| **GDP per capita** | 0.0000 | | 0 |

### 5.3 ARDL Model Output (Model 1)

Model 1 has maize production as the dependent variable and globalization as the main independent variable among others. Table 5.2 gives the results of the ARDL approach for model 1. This output is necessary in entailing the significance of different factors on maize production including the lagged values of the factors, which show how the past affects the current values.

*Table 5.2: ARDL Model (Model 1) Impact of Globalization on Maize Production*

Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): Globalization, GDP per capita
Fixed regressors: FISP Drought Constant
Selected Model: ARDL (3, 2, 0)
**Dependent Variable: Maize Production**

| Variable | Coef. | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| Maize Production (-1) | 0.145717 | 0.132376 | 1.100786 | 0.2790 |
| Maize Production (-2) | -0.141782 | 0.131877 | -1.075113 | 0.2901 |
| Maize Production (-3) | 0.284477 | 0.132105 | 2.153424 | 0.0387 |
| Globalization | 0.088000 | 0.028457 | 3.092419 | 0.0040 |
| Globalization (-1) | -0.020644 | 0.039180 | -0.526902 | 0.6018 |
| Globalization (-2) | -0.047970 | 0.029998 | -1.599077 | 0.1193 |
| GDP per Capita | 0.004400 | 0.001107 | 3.974163 | 0.0004 |
| FISP | 0.002846 | 0.230946 | 0.012323 | 0.9902 |
| Drought | -0.694839 | 0.124858 | -5.565017 | 0.0000 |
| C | -0.261094 | 0.472084 | -0.553066 | 0.5839 |

| | | | |
|---|---|---|---|
| R-squared | 0.904028 | Mean dependent var | 1.907612 |
| Adjusted R-squared | 0.877854 | S.D. dependent var | 0.889332 |
| S.E. of regression | 0.310817 | Akaike info criterion | 0.701198 |
| Sum squared resid | 3.188034 | Schwarz criterion | 1.110779 |
| Log likelihood | -5.075752 | Hannan-Quinn criter. | 0.852239 |
| F-statistic | 34.53882 | Durbin-Watson stat | 2.067168 |
| Prob(F-statistic) | 0.000000 | | |

### 5.3.1 Maize Production

The lags of maize production entail the adjustments that farmers make in producing maize depending on production levels for previous periods. The results show that the one-year lag of maize production increases maize production in the current year by 0.145717 tonnes. Two period lag of maize production has a negative sign, showing that current maize production is negatively affected by the production achieved two years ago. However, the negative impact is not statistically significant. The third lag for maize production has a positive coefficient,

which is also statistically significant. This implies that, a unit increase in maize production three years back increases production in the current year by 0.284477 tonnes. This result is likely because making adjustments in maize production takes time to reflect in production levels as farmers deal with issues of land size and access to inputs to affect the changes they want to make based on previous production levels. It is not surprising then that the impact is significant at the third lag of maize production.

### 5.3.2 Globalization

[1]The results show that globalization has a positive impact on the level of maize production in the current year. As shown in Table 5.2, a unit increase in globalization increases maize production by 0.08 tonnes. This impact is both positive and significant.

On lag level number 1 and 2, the results indicate that a unit increase in globalization in the previous year and lag 2 which represents globalization for 2 years ago, show that globalization does not positively affect maize production. Since the results for the lagged values are not significant, the study focuses on the impact of globalisation for the current year.

The implication for the results is that maize production increases with globalization in Malawi. This is likely the situation because globalization is associated with diffusion of agricultural and information technology. This increases access to improved maize technologies and ease of access of information dissemination on the use of improved maize varieties.

Additionally, other soil enriching technologies have been developed which also contribute to the increase in the maize output. According to Williamson (2001), globalization causes a growth in biotechnology, which has the potential to improve the yield of crops, raise the productivity even on land that lost fertility (Davis et al., 2001).

### 5.3.3 Gross Domestic Product Per Capita (GDP Per Capita)

As expected, GDP per capita shows to have a positive and significant (at 1% level) effect on maize production. A unit increase in GDP per capita increases maize production by 0.0044 tonnes. The sign is as expected. Increase in GDP per capita indicates economic growth, which is associated with increased people's ability to access farm inputs necessary for maize

[1] The interpretation of the ARDL output follow the following references: 1). Salahuddin, M., Vink, N., Ralph, N. & Gow, J., 2019. Globalisation, poverty and corruption: Retarding progress in South Africa. Development Southern Africa, 1-27.
2). Oyakhilomen, O. & Zibah, R.G., 2014. Agricultural production and economic growth in Nigeria: Implication for rural poverty alleviation. Quarterly Journal of International Agriculture, 53(892-2016-65234), 207-223.
3). Stoian, A. & Iorgulescu, F., 2020. Fiscal policy and stock market efficiency: An ARDL Bounds Testing approach. Economic Modelling, 5-7.

production. Agriculture being a backbone of Malawi's economy, increased economic growth means increases in most agricultural outputs like maize production.

### 5.3.4 Drought

In the short run, the expectation is that drought will hamper maize production thereby producing a negative impact. The probability value (0.0000) indicates that the occurrence of drought has a significant effect as it decreases maize production by 0.6948 tonnes.

A large percentage of maize is produced using annual rainfall, so a drought occurrence has a great impact on maize production. Climate change has affected the agricultural sector in a major way in most Sub-Saharan countries including Malawi. Drought is one of the major crises caused by climate change and impacts food availability and disrupts production. Additionally, the yield for major crops is affected, as well as livestock production and fisheries. Areas that are regularly affected by drought are prone to high food insecurity (FAO, IFAD & WFP, 2015).

### 5.3.5 Farm Input Subsidy Programme

The subsidy program for agricultural inputs is positively related to the production of maize. The results show that the farm input subsidy programme increases maize production by 0.0028 tonnes. The p value however indicates insignificance.

The input subsidy programme is aimed to improve adoption of improved inputs such as maize seed, the use of fertilizer and mainly to improve maize productivity (Chibwana et al., 2010). Other studies, such as Chibwana & Fisher (2011), suggest that the subsidy program has contributed to the increase in the use of fertilizer and maize yield in the recipient households. Results also show that FISP has helped farm households towards achieving food sufficiency. Even though there still exist food insecurity issues in Malawi, FISP is one of the programmes that has had a great impact in improving the food insecurity situation in Malawi (Chibwana & Fisher, 2011).

### 5.3.6 Other Variables

The variables Supplementary Input Programme, Starter Park, Malawi agricultural land, Population growth have been dropped from the model because their inclusion was leading to model overfitting and making the model fail to pass most diagnostic tests. Consumer Price Index was one of the variables that was supposed to be included in the analysis, but due to missing values, the data could not be used.

## 5.4 Diagnostic Tests for Model 1

Several diagnostic tests were performed to detect and correct for time series properties and to verify alignment of the model with the classical OLS regression assumptions. The following are the diagnostics tests that were conducted:

### 5.4.1 Functional Specification Test

OLS classical regression assumes that the model should be correctly specified in order to obtain meaningful results. The correct functional specification is in terms of no omitted variables, correct form, and correct measurement of variables. Violation of this assumption renders obtained OLS coefficient biased and inconsistent.

The study makes use of Ramsey-Reset specification test to check for the correctness of model specification. The test assumes that the model is well specified against an alternative hypothesis that the model is not well specified. A significant (insignificant) p-value shows that the test may reject (may not reject) the assumption of no functional form misspecification.

***Table 5.3: Ramsey-Reset Test Results***

| | |
|---|---|
| F-Statistic | **0.036116** |
| Probability value | 0.8506 |

Results from the Ramsey-Reset test show an insignificant p-value thereby failing to reject the assumption of correct model specification. This depicts that the model is correctly specified.

### 5.4.2 Serial Correlation Test

OLS application requires the error terms not to be serially auto-correlated for the analysis to achieve meaningful regression results. The study employed the Breusch-Godfrey Serial Correlation Test, which assumes that residuals are free of serial autocorrelation. The study proceeded with the analysis because the results of the test could not reject the assumption of no serial autocorrelation. Table 5.4 shows that the p-value is greater than all critical levels.

***Table 5.4: Breusch-Godfrey Serial Correlation LM Test***

| | | | |
|---|---|---|---|
| F-statistic | 0.352157 | Prob. F (2,31) | 0.7059 |
| Obs*R-squared | 0.955250 | Prob. ChiSquare (2) | 0.6203 |

### 5.4.3 Heteroscedasticity Test

Times series data requires the use of different techniques depending on whether the variance is constant (homoscedastic) or changing (heteroscedastic) across different observations. Applying the Breusch-Pagan-Godfrey Test, the study found no evidence of the presence of heteroscedasticity. As given in Table 5.5, the p-value exceed all critical values, thereby failing to reject the assumption that the error terms are homoscedastic.

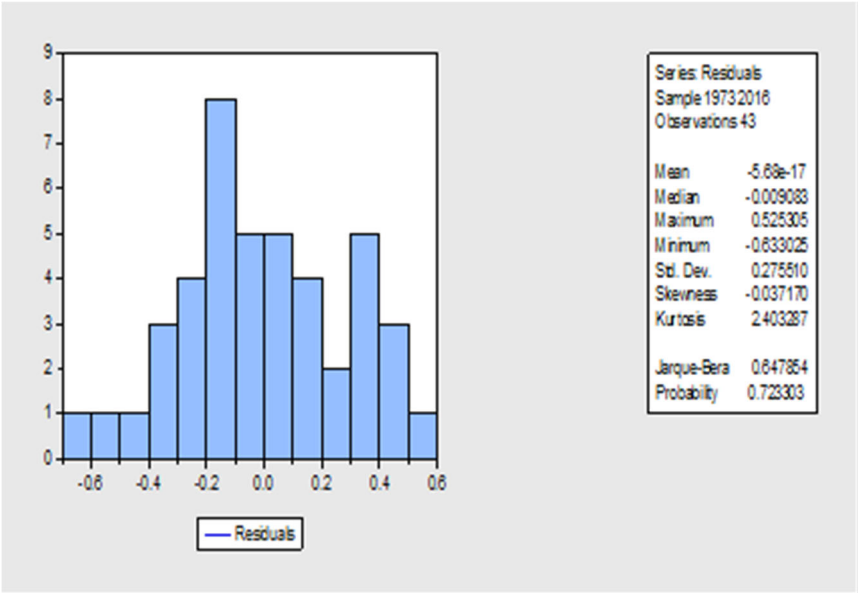
***Table 5.5: Heteroskedasticity Test: Breusch-Pagan-Godfrey***

| | | | |
|---|---|---|---|
| F-statistic | 1.048676 | Prob. F (9,33) | 0.4244 |
| Obs*R-squared | 9.563051 | Prob. ChiSquare (9) | 0.3870 |

### 5.4.4 Normality Test

In conducting the analysis, the study assumes that the error terms follow normal distribution. Violation of this assumption renders the classical test statistics invalid and the OLS coefficients unbiased. The normal distribution has the property that any linear combination of normally distributed variables is itself normally distributed. Normality of residuals is also significant in small samples where observations can be less than 100 (Gujarati, 2005). Using the Jacque-Bera Test, the study concludes that the residuals are normally distributed. Figure 5.1 shows the closeness of the shape to a bell shape of a normal distribution and the fact that the value of 0.647854 is close to zero.

***Figure 5.1: Normality Test Results***



### 5.4.5 Stability Test

The study used cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) from a recursive estimation to test for model parameter stability. Figure 5.2 and 5.3 shows the plot to lie within 5% bounds, indicating that the model parameters are stable over the sample period.

***Figure 5.2: Model stability (CUSUM Test) Results***

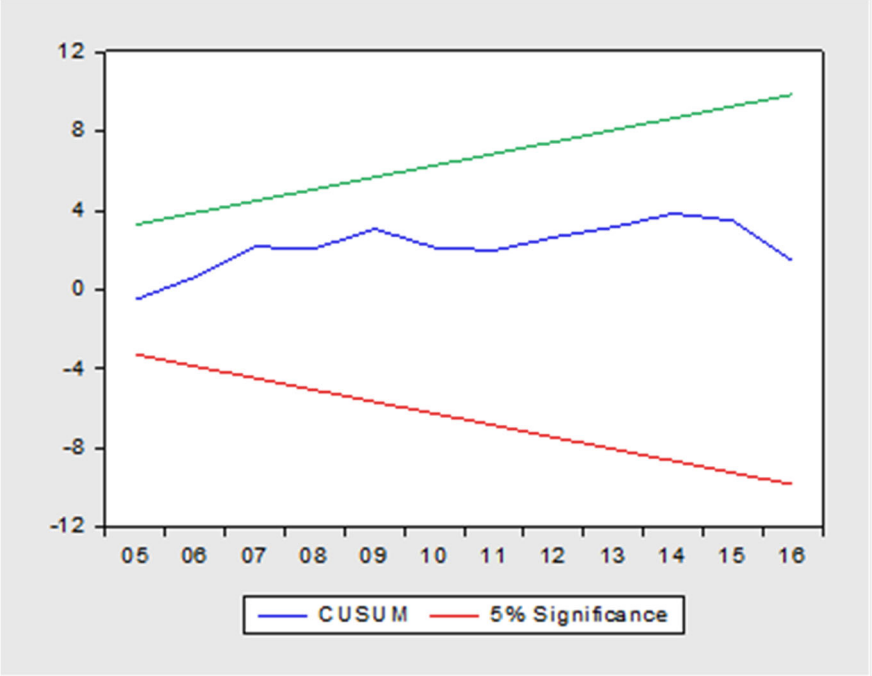
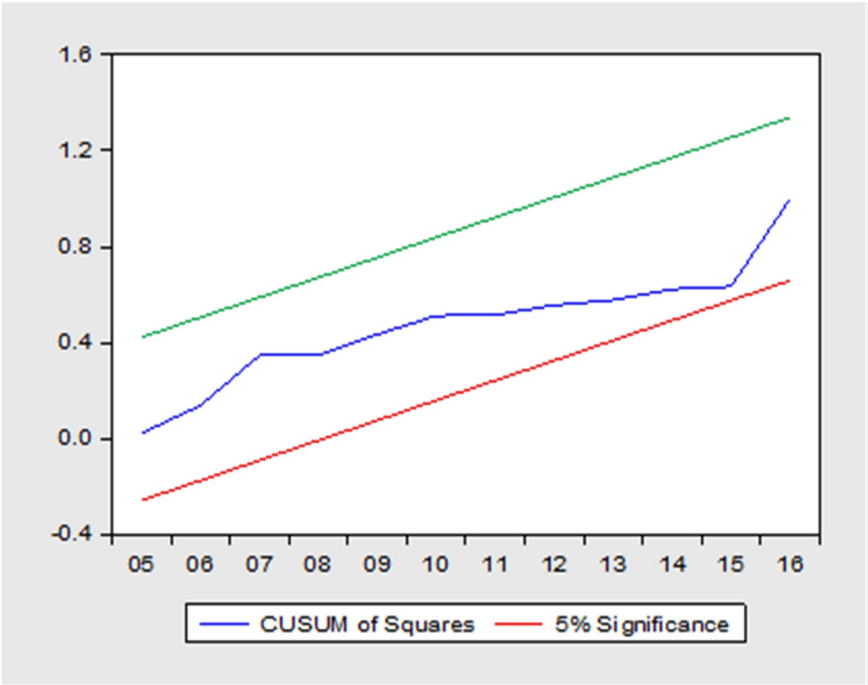



***Figure 5.3: Model stability (CUSUM Squares Test) Results***



### 5.5 Bounds Test for Co-integration for Model 1

The study used the ARDL model and applied the bounds test to co-integration. It is usually a common practice to estimate the model in a differenced form whenever the series are free of unit root; however, it leads to a loss in valuable information for the long run relationships. Co-integration solves this problem by investigating the presence of stationary linear combination of variables that have unit roots. It also does not require separate differencing of the data.

The bounds test makes use of critical values produced by Pesaran et al. (2001) against which the size of the F-computed statistic is compared. An F-statistic greater than the lower bound and upper bound critical values indicates that the variables are co-integrated.

Table 5.6 gives the outcome of the bounds test. The F- Statistic of 8.66 is higher than the lower and upper bounds[2], indicating the presence of co-integration.

***Table 5.6: Bounds test for Cointegration***

| **F-Statistic** | **Critical values** | |
|---|---|---|
| | Lower Bound I (0) | Upper Bound I (1) |
| 8.665893 | 2.63 | 3.35 |

### 5.6 Results for Error Correction Model 1

The short run model has been found to have numerous weaknesses in literature (Pesaran et al, 2001). Most importantly, it assumes that the underlying time series data is stationary therefore making radical assumptions, which have implications of spurious regression. To avoid this, the study identified nonstationary variables and tested them for their order of integration using differencing to make them stationary. The originally stationary variables together with the differenced stationary variables were used as regressors to estimate a long run model. In addition, the study generated residuals from the short run model and used them as one of the regressors (called error correction term). This model is what is called the error correction model and Table 5.7 presents the results:

[2] The critical values are obtained under the unrestricted intercept model with no trend and for 2 lags (based on AIC) using Pesaran et al. (2001) table.

*Table 5.7: Results of the ARDL Model with the Error Correction Regression*

**Dependent Variable: D (Maize Production)**

| Variable | Coef. | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D (Maize Production (-1) | -0.142695 | 0.117284 | -1.216660 | 0.2324 |
| D (Maize Production (-2) | -0.284477 | 0.119228 | -2.385992 | 0.0229 |
| D(Globalization) | 0.088000 | 0.025816 | 3.408713 | 0.0017 |
| D (Globalization (-1) | 0.047970 | 0.025200 | 1.903599 | 0.0657 |
| FISP | 0.002846 | 0.097594 | 0.029160 | 0.9769 |
| Drought | -0.694839 | 0.110605 | -6.282148 | 0.0000 |
| CointEq (-1) * | -0.711588 | 0.115717 | -6.149374 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.681755 | Mean dependent var | -0.007383 |
| Adjusted R-squared | 0.628715 | S.D. dependent var | 0.488378 |
| S.E. of regression | 0.297584 | Akaike info criterion | 0.561663 |
| Sum squared resid | 3.188034 | Schwarz criterion | 0.848370 |
| Log likelihood | -5.075752 | Hannan-Quinn criter. | 0.667392 |
| Durbin-Watson stat | 2.067168 | | |

The presence of D in the model signifies that the variable has been differenced. Table 5.7 shows consistency between the signs obtained in the short run model and those obtained using the long run model. The coefficient for maize production, shows that one lag maize production does not have a positive impact on maize production in the current year. Similarly, on lag number 2, the coefficient has a negative sign, showing that maize production for 2 years ago does not have a positive impact on current maize production.

The coefficient for globalization shows that globalization has a positive impact on maize production in the current year and also on lag 1. As shown in the Table, a unit increase in globalization increases maize production by 0.08 tonnes in the current year and by 0.0479 tonnes on lag 1. The impact of globalization on maize production is both positive and statistically significant at 5% level of significance in the current year and at 10% level of significance on lag 1. These results are unlike the results of the short run model which indicated

a negative impact on maize production for lag level 1 and 2 and only showed a positive, significant impact on the current year only.

Just like in the short run run, drought has a negative coefficient. The probability value (0.0000), indicates that drought has a statistically significant impact on maize production. This means that a drought occurrence decreases maize production by 0.6948 tonnes.

The subsidy program for agricultural inputs is positively related to the production of maize. The results show that the farm input subsidy programme increases maize production by 0.0028 tonnes. The probability value shows significance levels at 1%.

Table 5.7 also shows a negative coefficient for the error correction term of -0.711588, which is also significant at the 1% level. The ECM shows a speed of adjustment of 71.1% for the system to revert to equilibrium in response to shocks.

### 5.7 Unit root Test for Model 2 (Impact of Globalization on Food Supply)

The results show that globalization, GDP per capita, Agricultural land and food supply have unit roots. The data became stationary after differencing the variables once, thereby being integrated of order one I (1). The second column gives p-values of I (0) and the third column gives p values that became stationary after first differencing.

Notably, the ADF test results below are different compared to the ADF test results in table 5.1 (unit root results for model 1) because of the difference in the time range for the two models (the years for model 1 range from 1970 to 2016, while the time range for model 2 ranges from 1987 to 2013) hence the difference in the unit root test results for the two models.

***Table 5.8: Augmented Dickey Fuller Test results for Model 2***

| Variable | ADF in levels (P-value) | ADF in First Difference (P-value) | Integration Order |
|---|---|---|---|
| Globalization | 0.9015 | 0.0003 | 1 |
| Agricultural land | 0.9899 | 0.0000 | 1 |
| Log of food supply | 0.9181 | 0.0905 | 1 |
| GDP per capita | 0.0000 | | 0 |
| Population growth | 0.0052 | | 0 |

## 5.8 ARDL Model Output (Model 2)

Table 5.9 provides the results of the ARDL model where food supply is the dependent variable while globalization is the main independent variable among others.

***Table 5.9: Model showing the Impact of Globalization on Food Supply***

Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): Globalization GDP per Capita
Fixed regressors: FISP Drought Structural Break C
Selected Model: ARDL (1, 1, 1)
**Dependent Variable: Log of Food Supply**

| Variable | Coefficient | Std. Error | t-Statistic | Prob.* |
|---|---|---|---|---|
| Log of food supply (-1) | 0.823869 | 0.079701 | 10.33704 | 0.0000 |
| Globalisation | 0.002093 | 0.001109 | 1.886361 | 0.0764 |
| Globalization (-1) | -0.002231 | 0.001201 | -1.858011 | 0.0806 |
| GDP per Capita | 0.000498 | 0.000581 | 0.856748 | 0.4035 |
| GDP per Capita (-1) | -0.000865 | 0.000463 | -1.867787 | 0.0791 |
| FISP | 0.011613 | 0.008207 | 1.415058 | 0.1751 |
| Drought | -0.024709 | 0.006097 | -4.052593 | 0.0008 |
| Structural Break Dummy | 0.045317 | 0.008376 | 5.410249 | 0.0000 |
| C | 1.323742 | 0.572763 | 2.311150 | 0.0336 |

| | | | |
|---|---|---|---|
| R-squared | 0.987845 | Mean dependent var | 7.661682 |
| Adjusted R-squared | 0.982125 | S.D. dependent var | 0.081438 |
| S.E. of regression | 0.010888 | Akaike info criterion | -5.934875 |
| Sum squared resid | 0.002015 | Schwarz criterion | -5.499380 |
| Log likelihood | 86.15337 | Hannan-Quinn criter. | -5.809468 |
| F-statistic | 172.6983 | Durbin-Watson stat | 1.816916 |
| Prob(F-statistic) | 0.000000 | | |

### 5.8.1 Log of Food Supply

The results show that the lag variable of the log of food supply has a positive sign and it is statistically significant at 1% level of significance. The coefficient indicates that a unit increase in the log of food supply for the previous period increases current food supply by 82.38 kcal/capita/day.

### 5.8.2 Globalization

The results show that globalization has a positive impact on food supply. For the current period, a unit increase in globalization increases food supply by 0.2093 kcal/capita/day. This result is positive and significant at 10% level.

On lag level number 1, the results indicate that globalization of 1 year ago does not affect food supply positively. The implication is that globalization improves food supply in Malawi. This is likely the situation because globalization has the ability to control distribution, is beneficial to agricultural trade in terms of trade regulations and also its impact on the explosiveness of biotechnology. These factors increase imports and also increases production, thereby affecting food supply.

### 5.8.3 Gross Domestic Product Per Capita (Current $)

GDP per capita has a positive sign even though insignificant. An increase in GDP per capita leads to a rise in food supply by 0.0498 kcal/capita/day. The sign that was obtained from the results is as expected. The significance is however on lag level number 1, meaning that GDP per capita from 1 year ago has a significant impact on food supply. On lag level number 1, the results indicate that per capita GDP of the previous year does not have an effect on food supply.

Per capita GDP is used in this model as a measure for economic growth. Economic growth implies that there will be a reduction in hunger, malnutrition and poverty. It is expected that economic growth would improve food security because of its ability to increase employment and income (FAO, IFAD & WFP, 2015).

### 5.8.4 Farm Input Subsidy Programme (FISP)

The farm input subsidy programme is positively related to food supply. The results show that the farm input subsidy programme increases food supply by 1.1613 kilocalories per capita per day. The probability value however indicates insignificance.

The sign of the coefficient of FISP as expected because the farm input subsidy programme is aimed to improve adoption of improved inputs such as maize seed, the use of fertilizer and mainly to improve maize productivity (Chibwana et al., 2010).

### 5.8.5 Drought

Drought has a negative sign. The coefficient for drought indicates that a drought occurrence reduces food supply on average by 2.4709 kcal/capita/day which means that drought has a negative impact on food supply. Drought affects food production in Malawi which is the major

source of food because Malawi depends on its domestic production for food supply. Since Malawi is a country that relies on rain fed agriculture, any drought occurrence implies that food supply is affected negatively.

### 5.8.6 Other Variables

The variables Supplementary Input Programme, Starter Park, Malawi agricultural land, Population growth have been dropped from the model because their inclusion renders diagnostic test ineffective.

## 5.9 Diagnostic Tests for Model 2

### 5.9.1 Functional Specification Test

***Table 5.10: Ramsey-Reset Test Results***

| | |
|---|---|
| **F-Statistic** | **0.369344** |
| **Probability value** | 0.5762 |

The insignificant p-value in the Ramsey-Reset test fails to reject the assumption that the model specification is correct. There is therefore no evidence of omitted variables.

### 5.9.2 Serial Correlation Test

The high p-value shown in Table 5.11 indicates failure to reject the hypothesis that the residuals in the model do not contain serial correlation.

***Table 5.11: Breusch-Godfrey Serial Correlation LM Test:***

| | | | |
|---|---|---|---|
| F-statistic | 0.000737 | Prob. F (2,15) | 0.9993 |
| Obs*R-squared | 0.002555 | Prob. Chi-Square (2) | 0.9987 |

### 5.9.3 Heteroskedasticity Test

Table 5.12 gives a p-value that is more than all critical levels as a sign that the error terms are homoscedastic.

***Table 5.12: Heteroskedasticity Test: Breusch-Pagan-Godfrey***

| | | | |
|---|---|---|---|
| F-statistic | 1.527575 | Prob. F (8,17) | 0.2198 |
| Obs*R-squared | 10.87368 | Prob. Chi-Square (8) | 0.2090 |
| Scaled explained SS | 4.157217 | Prob. Chi-Square (8) | 0.8427 |

### 5.9.4 Stability Test

The plots for both cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) lie within 5% bounds, showing stability of the model parameters over the sample period.

***Figure 5.4: Test for Model Stability CUSUM Test Results***

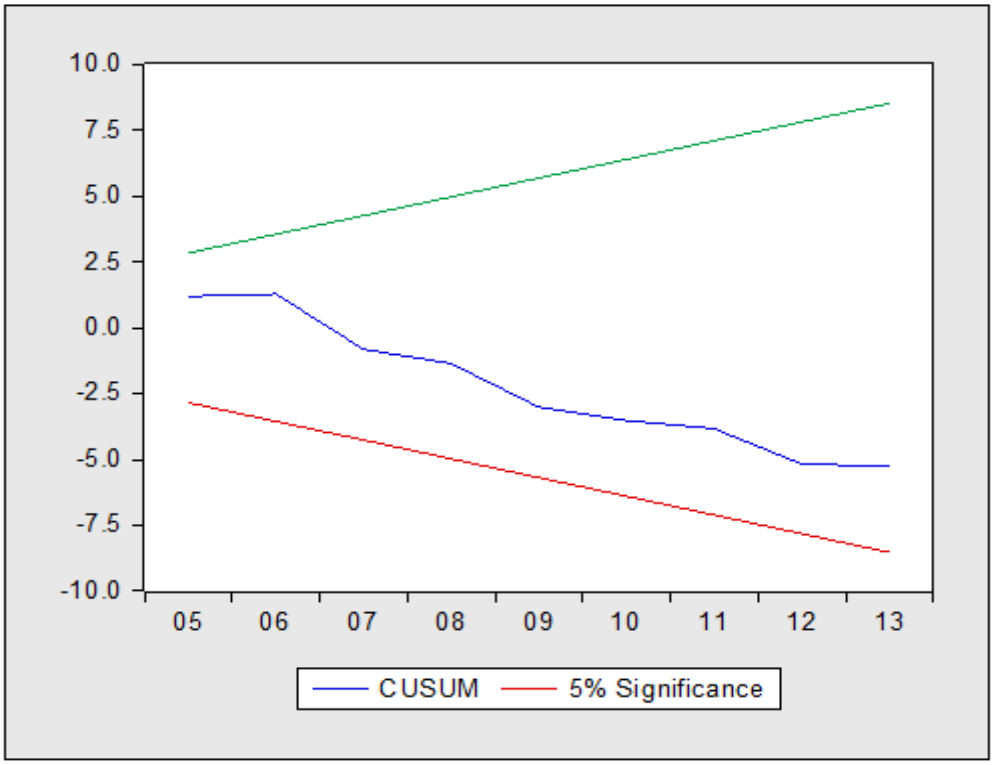
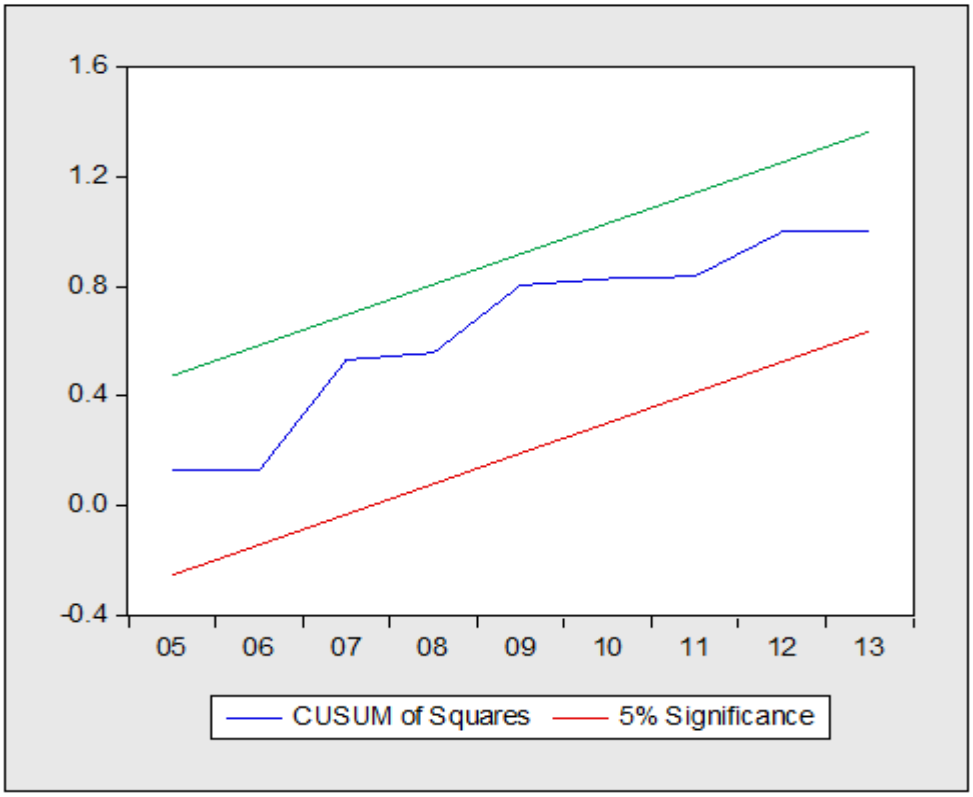


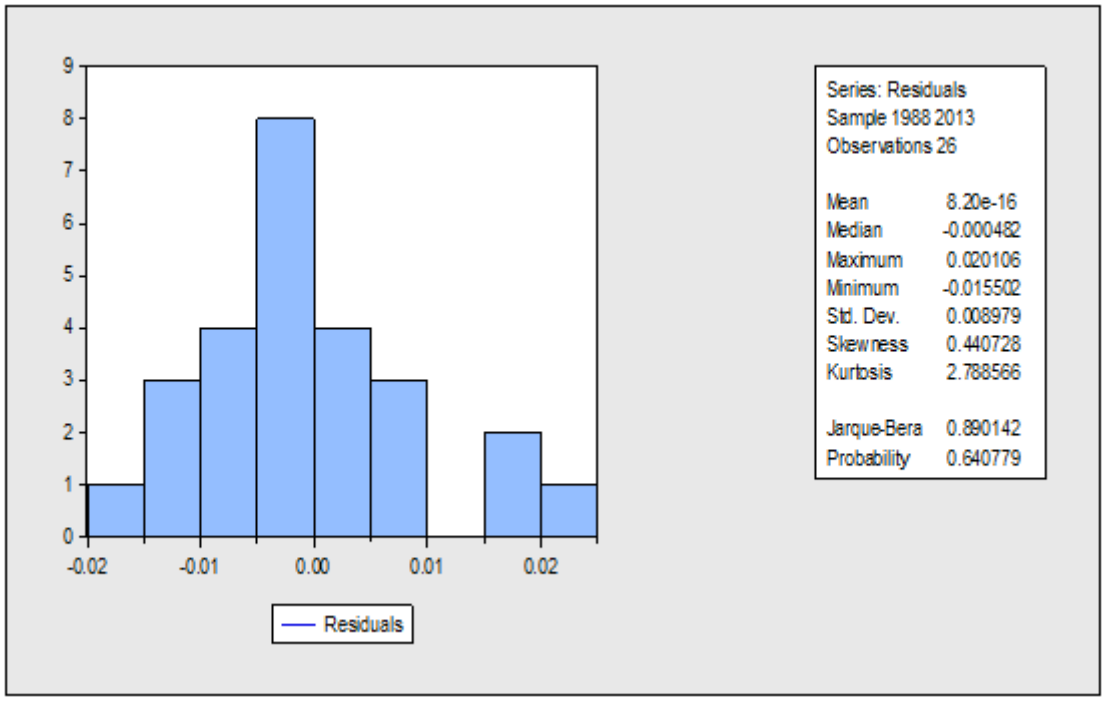
*Figure 5.5: Test for Model Stability CUSUM of Squares Test results*




### 5.9.5 Normality Test Results

The value of 0.890142 is close to zero, indicating that the data is normally distributed.

*Figure 5.6: Normality Test Results*




## 5.10 Bounds Test for Co-integration for Model 2

*Table 5.13: Bounds Test for Co-integration*

| F-Statistic | Critical values | |
|---|---|---|
| | Lower Bound I (0) | Upper Bound I (1) |
| 6.204455 | 2.63 | 3.35 |

Table 5.13 shows the F-statistic to lie above the lower bound and upper bound of all critical values, confirming the presence of co-integration.

## 5.11 Results for Error Correction Model for Model 2

The study also implemented the error correction mechanism for model 2. The results are given in Table 5.14 below.

*Table 5.14: Results for Error Correction Model for Model 2*

**Dependent Variable: D (Log of Food Supply)**

| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|---|---|---|---|---|
| D (Globalisation) | 0.002093 | 0.000829 | 2.524806 | 0.0218 |
| D (GDP per Capita) | 0.000498 | 0.000258 | 1.929134 | 0.0706 |
| FISP | 0.011613 | 0.005725 | 2.028713 | 0.0584 |
| Drought | -0.024709 | 0.004827 | -5.118624 | 0.0001 |
| Structural Break | 0.045317 | 0.005817 | 7.790630 | 0.0000 |
| CointEq(-1)* | -0.176131 | 0.032596 | -5.403465 | 0.0000 |

| | | | |
|---|---|---|---|
| R-squared | 0.853090 | Mean dependent var | 0.006557 |
| Adjusted R-squared | 0.816363 | S.D. dependent var | 0.023425 |
| S.E. of regression | 0.010038 | Akaike info criterion | -6.165644 |
| Sum squared resid | 0.002015 | Schwarz criterion | -5.875314 |
| Log likelihood | 86.15337 | Hannan-Quinn criter. | -6.082039 |
| Durbin-Watson stat | 1.816916 | | |

The presence of D in the model signifies that the variable has been differenced. The results show that globalization has a positive impact on food supply in the current year. A unit increase in globalization increases food supply by 0.2093 kilocalories per capita per day, globalisation is statistically significant at 5% level of significance. GDP per capita has a positive impact on food supply and is statistically significant at 10%. Farm input subsidy shows a positive relationship on food supply, unlike in the short run where the subsidy programme indicated insignificance, in the long run, the subsidy programme indicates a positive sign and shows that the programme increases food supply by 1.163 kilocalories per capita. Finally, the sign on drought is the same as it is in the short run model, showing that drought has a negative impact on food supply, thus a drought occurrence decreases food supply by 2.47 kilocalories per capita per day.

Table 5.14 also gives the coefficient of the error correction term (-0.176131) which is negative and significant at the 1% level. The ECM gives the model's speed of adjustment (17.6%) to equilibrium in response to shocks.

## 5.12 Summary and Conclusion

This chapter presented the Autoregressive Distributed Lag (ARDLs) empirical estimation findings. It also reports the various diagnostic tests results of stationarity tests, co-integration tests, and other various tests. There was a cointegration relationship in both models, and the outputs in Model 1 and 2 passed all the diagnostic tests. The first set of results to be presented are the short run results for model 1, which show the impact of globalization on maize production followed by the results for the long run model. The results for the short run and long run model show that globalisation has a positive impact on maize production and food supply.

According to the short run model, globalisation increases maize production by 0.08 tonnes and the relationship is statistically significant at a 5% level of significance. In the long run, the results show that globalisation increases maize production by 0.08 tonnes in the current year and by 0.0479 tonnes on lag 1. The impact of globalisation on maize production is both positive and statistically significant at 5% level of significance in the current year and at 10% level of significance on lag 1.

The findings of the impact of globalisation on food supply also indicate a positive impact. The results for the short run model show that globalisation increases food supply by 0.2093 kilocalories per capita per day and is statistically significant at 10% level. In the long run the results show that globalisation has a positive impact on food supply in the current year and that globalisation increases food supply by 0.2093 kilocalories per capita per day and it is statistically significant at 5% level of significance.

The long run results for both models also have an error correction term coefficient. For model 1, the coefficient has a negative coefficient for the error correction term of -0.711588, which is significant at 1% level of significance. The ECM shows a speed of adjustment of 71.1% for the system to revert to equilibrium in response to shocks. For model 2, the coefficient also has a negative sign, the error correction term coefficient for model 2 is 0.176131 and is significant at 1% level of significance. This means that the model's speed of adjustment to equilibrium in response to shocks is 17.6%.

# CHAPTER 6: CONCLUSIONS AND RECOMMENDATIONS

## 6.1 Summary, Conclusions and Recommendations

There are so many ways in which globalisation has affected food systems in the world and the world's poor. This has in return had an impact on food security in many developing countries. So many changes have taken place due to the globalisation processes. Globalisation is known for increasing the proportion of traded foods across borders more than domestic production, the increase in the agricultural inputs through international trade and also cross border investments. Furthermore, globalisation also contributes to the improvement in science, information and technology, and also the coming together of nations through international bodies such as WTO which promote the implementation of flexible trade regulations and the setting up of multinational companies. In addition, literature has revealed that there has been an increase in innovation and a great investment and involvement in agricultural research and development. This chapter summarizes the findings of the study, explains briefly the impact of globalisation on the food security state of developing countries, the policy implications and recommendations.

The study has provided a link between food security and globalisation by stating its advantages that it promotes trade, technology diffusion and easy flow of inputs, capital and investments. The study has two study periods, the first period is from 1970 to 2016 and the second study period is from 1987 to 2013. The first study period covers the data for the first model which investigates the impact of globalisation on food availability and access, while the second period covers the second model which investigates the impact of globalisation on food supply. Originally, the data for the second model had a data set covering the period of 1970 to 2013, however due to the presence of a structural break in the trend, that was caused by political reforms from 1992 in Malawi, the data was split to avoid the econometric issues that arise due to structural breaks.

Other factors were identified that affect food security such as food prices, weather changes, the area of cultivated land, population growth, per capita GDP and the impact of introducing the farm input subsidy programme in 2004 and other input subsidy programmes such as starter pack and supplementary input programmes that existed before the current farm input subsidy programme known as FISP.

The study employed an ARDL Model for its analysis. ARDL models are models that include lagged values of the variables of interest and trace relationships among them over time (Greene,

2008). The method also helps to determine the existence of co-integrating relationships between variables. Further, diagnostic tests were conducted to confirm that the models were properly specified and would give adequate and accurate results.

The results from the study state that globalisation has positive impacts on food availability and access in Malawi particularly on maize production and food supply which have been selected as measures of food availability and access in Malawi in this study.

Specifically, the results for the short run model show that globalisation has a positive impact on maize production in the current year. Globalisation increases maize production by 0.08 tonnes and the relationship is statistically significant at a 5% level of significance. In the long run, the results show that globalisation increases maize production by 0.08 tonnes in the current year and by 0.0479 tonnes for a one year lag. The impact of globalisation on maize production is both positive and statistically significant at 5% level of significance in the current year and at 10% level of significance for a one year lag. The implication for the results is that globalisation in agriculture, is associated with diffusion of information technologies, communication, improved transportation and the ability to adopt new technologies and expertise (Kennedy, et al., 2004). This in return, increases access to improved maize technologies and also ease of access of information dissemination on the use of improved maize varieties. Besides that, other soil enriching technologies have been developed which also contribute to the increase in the maize output. Williamson (2001), found that globalisation causes a growth in biotechnology and in turn, the growth of biotechnology has the potential to improve the yield of crops, raise the productivity even on land that lost fertility (Davis et al., 2001).

Gross Domestic Product per capita was used in this study as a measure of economic growth. Economic growth helps alleviate hunger, malnutrition and poverty. That is because economic growth entails an increase in employment and income. When income increases in households through employment and wages, household members are able to afford purchasing seeds and adopt new technologies. GDP per capita indicated a positive sign in the output of the model, and it was significant at 1% level, meaning that a rise in GDP per capita entails an increase in maize production in Malawi.

Furthermore, climate change has affected the agricultural sector in a major way in most Sub-Saharan countries including Malawi. Drought is one of the major crises caused by climate change and impacts food availability and disrupts production (FAO, IFAD & WFP, 2015). In

the long run and short run, a drought occurrence indicated a negative impact on maize production. A large percentage of maize is produced using annual rainfall; therefore, any drought occurrence causes a decline in maize production. The results from the model indicated that a drought occurrence decreases maize production by 0.6948 tonnes.

The findings of the impact of globalisation on food supply also indicate a positive impact. The results for the short run model show that globalisation increases food supply by 0.2093 kilocalories per capita per day and was statistically significant at 10% level. The implication of this is that globalisation improves food supply in Malawi. This is likely the situation because globalisation has the ability to control distribution, it is beneficial to agricultural trade and contributes to the explosiveness of biotechnology. In the long run the results show that globalisation has a positive impact on food supply in the current year. The results indicated, that globalisation increases food supply by 0.2093 kilocalories per capita per day and it was statistically significant at 5% level of significance. Just like maize production economic growth also has a positive impact on food supply. Due to intensive agricultural research and development there has been an introduction of high yielding crop varieties and improved farming technologies. These improved crop varieties have also had an impact on crop productivity as well as food supply. Input subsidies have also played a major role in ensuring ease of adoption of new technologies. The Farm Input Subsidy Programme in Malawi has helped most farmers that could not afford purchasing improved maize seeds and chemical fertilizers.

From the model findings, it can be concluded that: even though it is established that globalisation has a positive impact on food availability and access in Malawi, the magnitude to which globalisation affects food availability and access is very minimal. Therefore, deliberate interventions have to be made to ensure that the benefits of globalisation are enhanced. In the past agricultural and food trade were regarded as the key drivers of globalisation. However, with the passage of time, the focus is more on changes in technology and the transmission of information. The agricultural performance has been fluctuating with significant decreases in the trend. Over the decades it has been noted that food supply has changed and maize production has increased, with some notable declines in the years that Malawi encountered some climate related weather shocks such as drought. That means that globalisation alone has not been enough to achieve the food security goals in most developing countries, due to other factors such as insufficient rains, input prices and also the income levels of the farmers which

pose as a detriment to achieve high levels of productivity and attain the maximum benefits of globalisation.

In order to ensure that the population benefit from globalisation in terms of food availability and access, there should be an improvement in infrastructure so that improved seed varieties that are introduced by technological changes can be assessed by all. For instance, farm input subsidies which are one of the ways to improve the adoption of new crop varieties have a positive impact on food security as such they should be intensified and better allocation procedures should be identified to ensure that free and cheap inputs are accessed by all the population in Malawi. Additionally, the existence of transaction costs has a bearing on the extent at which the population benefits from globalisation, lack of access to information, infrastructure and marketing institutions limits most farmers from benefitting from globalisation. As such reduction of transaction costs will also help to improve the impact of globalisation on food availability and access.

In terms of international trade, Malawi should commit itself to trade and take advantage of the reduced tariffs, as the tariff reduction decreases the price of goods and the cost of production. The arrival of more imports due to lowered tariffs decreases domestic food prices, making food even more affordable to the population.

Furthermore, economic growth and stable macroeconomic policies promote foreign direct investments. A good economic environment promotes the presence of investment companies and food markets thereby improving food availability due to the reduced prices of inputs that are used for production and the reduced food prices from the food markets.

Building human capital through literacy and training will help farmers take advantage of opportunities that arise with globalisation. With improvement in knowledge and skills, farmers will increase production and food supply with the acquired skills. Biotechnology has been identified to be the solution to food insecurity problems in developing countries, implying that introducing skills and knowledge will promote best practices from the farmers thereby enhancing productivity and increasing crop production. Additionally, investments in research, development and irrigation can also improve food availability and access, therefore intensifying adoption of these interventions will promote the globalisation impacts on food availability and access.

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